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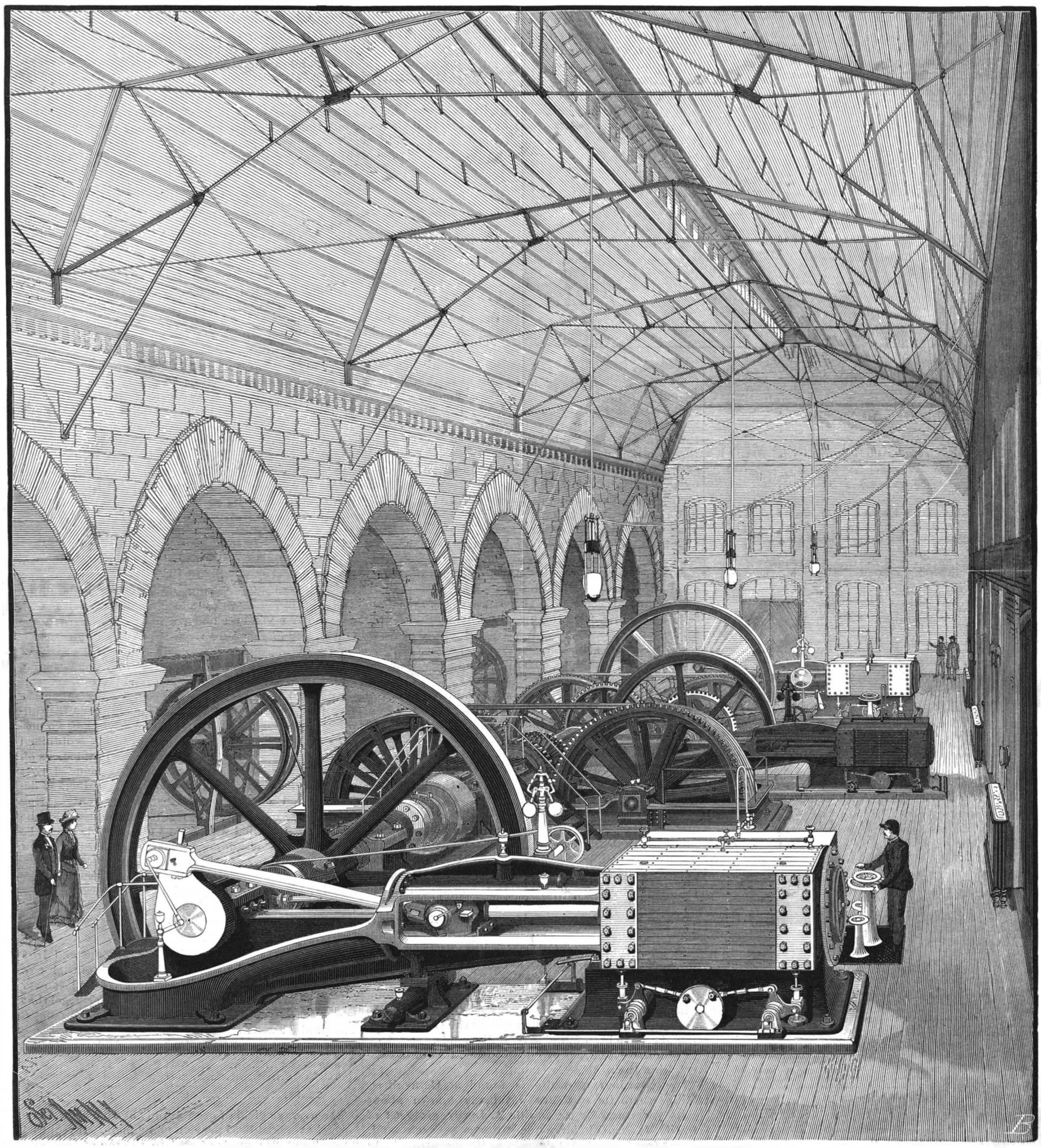
IMPROVEMENTS IN THE CABLE RAILWAY OF THE NEW YORK AND BROOKLYN BRIDGE.

Our readers who have not seen the great East River Bridge which connects New York and Brooklyn have been made familiar with its appearance and the details of its construction through the frequent and profusely illustrated articles on the subject which have appeared in these columns from time to time. It is not necessary, therefore, to go into minutiæ regarding the structure itself, but it will, perhaps, be well to repeat in brief some of the dimensions of the bridge, and give some facts regarding the traffic.

The bridge is 5,989 feet long, 85 feet wide, supported by four 15¾ inch wire cables. It is divided into five longitudinal divisions: the carriage ways being at the outside, the elevated promenade in the middle, and the two railways between the promenade and the carriage ways. An endless cable, 1½ inches in diameter, extends from the engine house in Brooklyn over sheaves at the center of the railway track to the New York terminus, thence across underneath the New York approach to the other railway, returning in the same manner.

The propelling plant, which has been in use upon the bridge from the day of its opening up to the present time, consisted of two horizontal steam engines, each having a cylinder 26 inches in diameter, a stroke of 48 inches, with a fly wheel 18 feet in diameter, weighing 30,000 pounds. These engines have been operated one at a time, jaw clutches being provided for throw-

(*Continued on page* 39.)



NEW CABLE DRIVING PLANT OF THE NEW YORK AND BROOKLYN BRIDGE.

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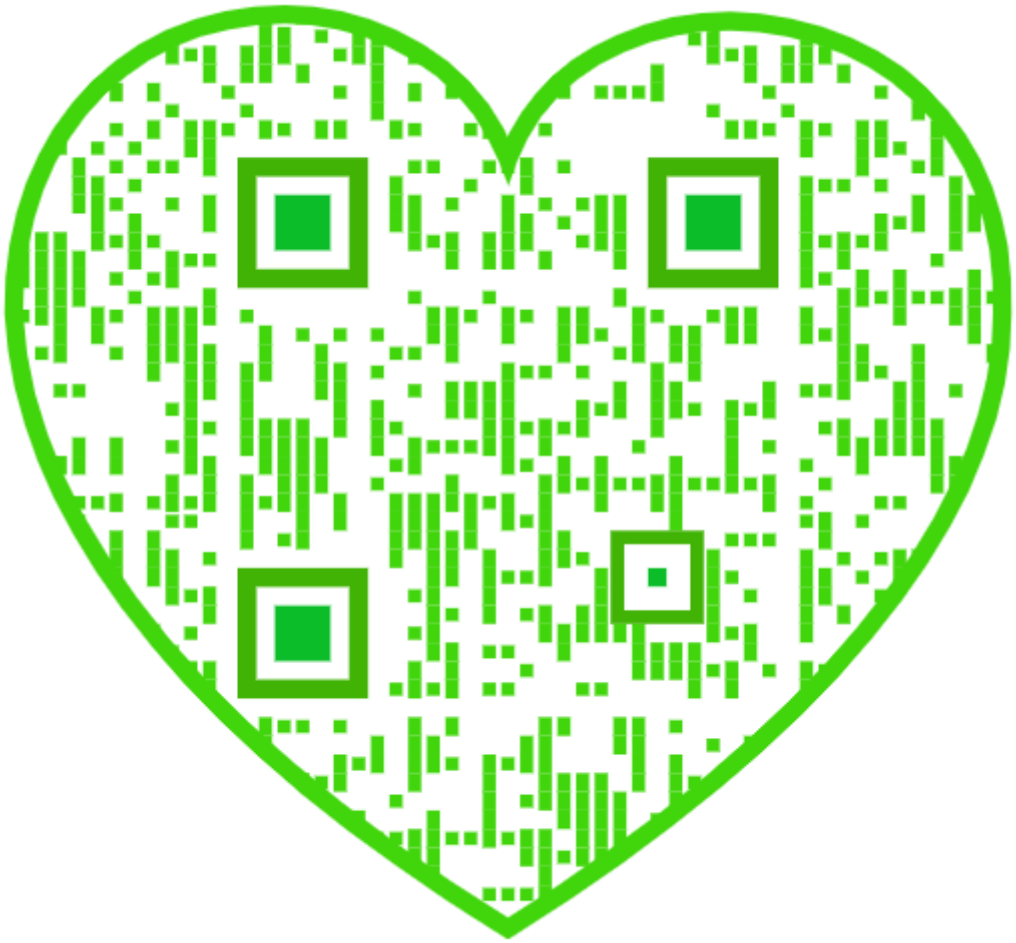

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Salida Springs and Mines.

As a health resort this young and growing city, with a present population of about 3,000, promises to rival Colorado Springs, Col.

Situated in the heart of the Rocky Mountains, in the valley of the Arkansas River, at its junction with the South Fork, at an altitude of about 7,000 feet, and surrounded by lofty and snow-covered peaks, averaging 14,000 feet high, with many hot and cold mineral springs of medical virtues at hand, and an equable climate devoid of sudden and severe changes, it offers superior advantages as a residence to consumptives and other invalids.

Snow is seldom seen on its streets during the most severe winters. The high peaks by which it is surrounded protect it from the protracted snow and rain storms sweeping in from the plains, that are so often experienced in towns adjacent to the easterly foot hills of the Rockies. Salida is Spanish, meaning a clear view.

The Sedalia Copper Mine, of Salida, Col., is one of the extremely few lucrative copper properties within the boundaries of a State where gold, silver, and lead ores predominate. It is located in the Rocky Mountains, in the valley of the Arkansas, on the line of the Denver and Rio Grande Railway, 100 miles west of Pueblo.

On account of the low price of copper and the indifferent management of its owners, it was abandoned for a time; but the recent advance in the metal attracted to it the attention of some skilled metallurgists, who leased the property for a term of years and at once shipped the entire dump to market. They have since prosecuted the work with such judgment and activity as to yield them handsome returns, and are now shipping about seventy tons of its ore daily, the average grade of which is from 25 to 30 per cent copper. One vein of black oxide, one foot wide, averages 68 per cent copper.

Owing to the difficulty in obtaining satisfactory treatment of the ore at the West, it is now shipped through by rail to New Jersey and New York, at a transportation cost of $13 to $16 per ton.

A tramway is in construction to connect the mine on the mountain side with the Denver and Rio Grande Railway, which will greatly facilitate operations.

Zirconia Minerals.

At the last meeting of the New York Microscopical Society Mr. George F. Kunz exhibited sand containing monazite, phosphate of cerium, lanthanum, and didymium containing from 0 to 17 per cent of thoria, from Brindletown, Burke County, N. C., and monazite sand from Caravalhas, Brazil, stating that the demand for these minerals had greatly increased of late, owing to the rare earths zirconia, thoria, glucina, etc., which they contain, and which are now used for the mantle or hood of the new incandescent gas burner invented by Dr. Carl Auer, now Von Welsbach, of Vienna. This increased consumption has led to a search by the collectors and dealers in minerals in England, Germany, France, Russia, Norway, and Brazil, and more especially in the United States, and so thorough has the search been that the prices of minerals which were considered rare a short time ago are now quoted at one-tenth to one-hundredth former figures.

The minerals containing these rare earths are: Lanthanite, sipylite, tysonite, uranothorite, orangite, thorite, clevite, monazite, beryl, yttrotantalite, alvite, erdmannite, cerite, xenotime, fergusonite, aeschynite, allanite, zircon, endialyte, euxenite, samarskite, gadolinite, and bodenite.

Of these, beryl, cerite, monazite, allanite, and zircon have been obtained in large quantities.

Sipylite, orangite, and thorite are specially sought for.

Monazite has been found at the following localities: Villeneuve, Ottawa County, Canada, a crystal of 14½ pounds; Alexander County, N. C., at Milholland's Mill; Amelia County, Va., in 20 pound lump; Norwich, Conn.; Ural Mountains, Mt. Sorel (var. turnerite), Tavetch (var. turnerite), Binnenthal, Switzerland; Southern Ural, River Sanarka; Arendal, Norway.

At these localities the occurrence is of mineralogical interest only, except at some of the North Carolina, Georgia, and Brazilian localities, where it can be obtained in quantity for commercial use.

In the North Carolina gold gravels of Rutherford, Polk, Burke, McDowell, and Mecklenburg counties monazite is found in considerable quantities in small brown or greenish or yellowish brown monoclinic crystals, associated with chromite, garnet, zircon, anatase, corundum, menacanite, xenotine, fergusonite, epidote, columbite, samarskite, and other minerals. With these associations in North Carolina and at the Glade Mine, Georgia, have been found several diamonds.

From these localities will be furnished tons of monazite within the next twelve months.

The Brazilian monazite is found at Caravalhas, Bahia, where its existence was made known about eight years ago by Dr. Orville A. Derby, geologist of Brazil. It occurs in large quantities as a beach sand, almost free from other minerals, as if concentrated. As it occurs on the coast, it can easily be shipped to any point where it is wanted, and a number of tons have been sent to the United States.

The best zircon locality is on the old Meredith Freeman estate, Green River, Henderson County, N. C. The lease was for 25 years in the hands of Gen. T. L. Clingman, of that State, who, as early as 1869, mined 1,000 pounds of it, and who during that whole period never lost faith in the incandescent properties of zirconia, but when the time of its adoption actually came, through some legal difficulties the General had forfeited his leases, and hence failed to reap his reward.

In Henderson County, N. C., and in Anderson County, S. C., zircons are found in large quantities loose in the soil, as the result of the decomposition of a feldspathic rock. The crystals are generally remarkable for their perfection, weighing occasionally several ounces, and are distinctive at each locality. The recent demand has also brought to light the existence of enormous quantities of zircon in the Ural Mountains and in Norway.

Although in Canada, in Renfrew and adjoining counties, enormous crystals have been found up to 15 pounds each, yet they are so isolated that it would be impossible to obtain a supply there.

The new demand has brought together more than 25 tons of zircon, 10 tons of monazite, 6 tons of cerite, thousands of pounds of samarskite, and tons of allanite and other minerals. As a consequence, zircon is now offered at less that 10 cents a pound, monazite at 25 cents, and samarskite at 50 cents.

Why Mechanics are Out of Employment.

There are said to be many thousands of mechanics and other workmen in Chicago out of employment. This is not altogether due to local causes, says our contemporary, the *American Artisan*, for it is true that men are constantly flocking here from every quarter expecting to find employment, only to find the labor market already glutted. The daily papers tell us there is a surplus of labor in other cities also, and consequently large numbers are idle. Part of this is due to the rapid influx of people from other countries, who largely gravitate to the large cities. But in Chicago it is the fact that her own workingmen might be nearly all employed but for their own agitation and unwise demands. The strikes and the threatened strikes among the mechanics of the building trades at the beginning of the season had the effect of deterring many capitalists from making contracts for contemplated new building enterprises and other improvements, by an apprehension of delays and annoyances from labor disturbances. It is safe to say that the investment of millions of dollars, which at the beginning of the season were ready to be put into new business and residence structures in various portions of the city, was frightened into other channels on this account. All kinds of businesses dependent for a portion of their prosperity upon the amount of building which is being done feel the effect of this, as well as do the workmen themselves.

Decomposition of Silk.

Dr. Weyl lately gave an account before the Physiological Society, Berlin, of the results of his further researches on silk. Among the products of decomposition of albumen and proteid substances, one is known as a snowy crystalline body, which is considered to be leucin, and is generally regarded as being also a product of the decomposition of silk. Since this substance may be obtained in large quantities by the decomposition of silk, the speaker had prepared it from this source and analyzed it, and has come to the conclusion that it is not leucin (amidocaproic acid), but rather another amidated acid, namely, alanin. Of the two possible isomers of alanin, it is *a*-alanin which is obtained by the decomposition of silk. Dr. Weyl laid stress on the fact that Schutzenberger had also concluded that alanin and glycocol occur among the products of decomposition of silk, nothwithstanding that, during his elaborate and careful researches on proteids, he employed a method which is as unfavorable as can be imagined for determining this point, this result is now confirmed by the speaker's researches. Schutzenberger's further supposition, that an amido-acid of the acrylic series can be prepared from silk, was not supported by Dr. Weyl's analyses.

Long Run of a Furnace.

Mr. G. C. Stone, of the New Jersey Zinc and Iron Company, Newark, N. J., reports that one of their two furnaces recently blew out after the longest blast ever made at the works, and the longest run on spiegel that has yet been made, being three years and two days. The product was:

	Tons.	Cwt.	Pounds.
First year.....	3,340	10	70
Second year.....	3,443	13	57
Third year.....	3.090	8	79
Total.....	9,874	12	94

The average yield of ore was only 31·5 per cent. The spiegel averaged 19·55 per cent manganese. It required 2 tons 9 cwt. 22 pounds of coal to the ton of iron, and made about 6,000 pounds slag to each ton of iron.

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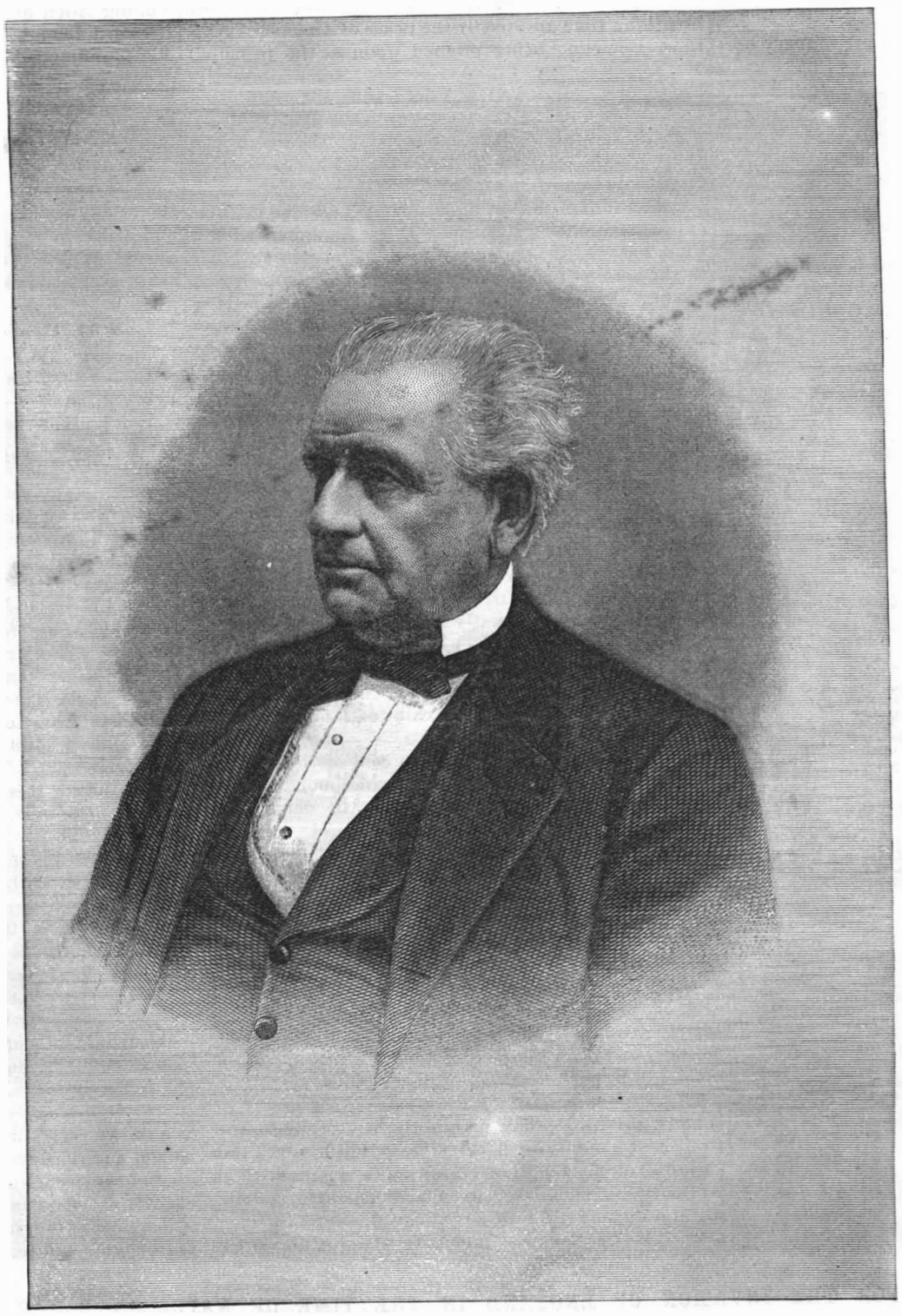
HIRAM SIBLEY.

On the morning of July 12, at half past ten, Hiram Sibley, the founder of the Sibley College of Mechanical Arts, died after an illness of five days. Until the end of the preceding week he had seemed in his usual health, but on Sunday, July 8, he was stricken with apoplexy. For much of the time intervening between this period and his death he was unconscious.

The history of his life is a remarkable one, and shows him to have been the typical self-made American. He was born in North Adams, Mass., February 6, 1807. After a few years of schooling, before he was 16 years old, he was apprenticed to a shoemaker. It is said that he watched a shoemaker working, and then declared that he could make a shoe. The offer was accepted, and he sat down and made his first attempt at a boot. This was the origin of his apprenticeship. The trade, however, was distasteful to him, and he entered a cotton factory, and subsequently tried wool carding and machine work, so that when he was 21 years of age he knew five trades.

In 1843, after a number of successful business ventures on his own account, he was elected sheriff of Monroe County, N. Y. But his political aspirations were cut off by a subject of greater interest. Professor Morse was at this time in the midst of his experiments, and the mind of the eminently mechanical Hiram Sibley saw in them the germ of a great future. In 1840, three years before this time, Mr. Sibley had gone to Washington with Ezra Cornell to assist Prof. Morse in obtaining an appropriation of $40,000 to put up the Washington and Baltimore line. It was secured, and the first practically operative line was erected. Other inventors were stimulated by Morse's success, and soon many telegraph companies were established all over the United States. It was to the consolidating of these rival interests that Mr. Sibley addressed himself. He gradually succeeded in buying up their stock, securing some of it at a nominal value, and effected the desired unification, founding the Western Union Telegraph Company as the successor of the many rival corporations. He held the presidency of the new company for sixteen years. The company started with 132 offices and $220,000 capital. When he left it, 4,000 offices were in operation, and its property was estimated at $40,000,000.

His next great achievement was the erection of a telegraph line to San Francisco from the Eastern States. As soon as this was done, he tried to carry out the project of uniting the eastern and western hemispheres by a telegraph line by way of Alaska and Siberia. The work was begun, and would doubtless have been carried out, had not the Atlantic cable interfered. But the successful laying of this link did away with the necessity for the longer land line, and the enterprise was abandoned, at a loss of $3,000,000.



Hiram Sibley

His other business ventures were of much importance also. Railroads and farming were alike included among his ventures. In Illinois he owned a farm of 40,000 acres. This he divided into tracts, erected a house and barn on each portion, and let it out on shares. About one hundred and fifty tenants occupy it. For the handling of the crops an elevator and corn shelling mill is provided, built upon the line of the railroad which runs through the property.

He was the proprietor of a most extensive seed and nursery business at Rochester, N. Y. In conducting it he used every means to insure success and high grade of product. Much of his seed was raised abroad, all large lots were tested, and by premiums he endeavored to improve the quality. This business, now of immense dimensions, he started in 1869, when he retired from the Western Union Telegraph Company.

Rochester, N. Y., was for most of his life his home. In 1843 he settled there, and for forty-five years was one of its prominent citizens.

His early association with Ezra Cornell has been noticed. He was named as one of the incorporators of Cornell University, and has been one of the benefactors of the great institution, by founding the Sibley College, now under the management of Professor Robert H. Thurston. His other benefactions are numerous. The fortune he left is very large, being estimated at seven to ten millions of dollars.

America the Military School for Europe.

Col. A. G. Adae, late captain 4th Ohio Volunteer Cavalry, read recently before the Ohio Commandery of the Military Order of the Loyal Legion a very interesting paper, which appears in the Ohio *Soldier*. It is mainly devoted to a description of the German autumn maneuvers, which Captain Adae witnessed during a visit to his mother's home in Germany. Comment ing upon them, he says: "I presume it would sound very distasteful to German military men, and would probably be promptly repudiated by them, when I state that the Germans have learned a great deal from us, and have adopted many features which were brought forward during our war, but, as some newspaper men are wont to do, without giving credit. When it has been the fashion among European military men to speak of our armies as armed mobs, and to characterize our battles as bushwacking on a large scale, it gives me very great pleasure to state right here, from personal observation, that since our war they have made almost a complete change in their infantry tactics, that in their late wars the employment of their cavalry is an almost exact copy of what we did here, that their ambulance service and field hospitals, as well as their field signal service, are largely our inventions and copied from us. Thirty years ago the idea of soldiers fighting while lying flat on the ground and not only taking advantage of every inequality of the ground, but hastily digging themselves in, would have been ridiculed by German military men, in fact, they would have probably pronounced it rank cowardice.

Now, what was my astonishment to see whole regiments precipitate themselves flat on their respective stomachs, hastily digging up a little trench in front of them with short-handled spades, which a number of each company carry on their knapsacks, and firing away for dear life, never letting on that they had learned all that from our Atlanta and other campaigns, where rifle pits were first brought into perfection. Yes, here, instead of their old style of standing shoulder to shoulder, stand up in a solid mass, shoot and be shot at, they send out their infantry in open order, fight on the skirmish line, which was always our boys' special delight, and in which the American soldier beats the world, hide on the ground—why, I believe they would hide behind trees if they had many in their country. What does their cavalry do? What were the famous Uhlan incursions into France, with their cutting of railroads, blowing up of bridges, scaring the people generally, but a reproduction of our great cavalry raids under a Kilpatrick, Custer, Stoneman, and Long on our side, or of Stewart, Wheeler, and Morgan on the wrong side of the house? This mode of using cavalry, instead of sending it against each other to destroy itself in furious and generally resultless onslaughts, was clearly first brought out by us."

This confirms the testimony on this point recently presented here, in a communication from an English officer in India, which was furnished to us by the editor of the *Century Magazine*. Not only are the European soldiers indebted to us now, as they always have been, for the suggestions of some of the most radical changes in the art of war, but it is from American inventive genius that the improvement in the machinery of war is largely derived.—*Army and Navy Journal.*

The Military Microphone.

An adaptation of the microphone to military purposes is at present under essay at Montauban, and, so far, with satisfactory promise. At the conclusion of the yearly period of training of the 132d regiment of Territorial Infantry, trials were made with a microphonic apparatus, invented by Lieutenant Desbordieu of the same corps. Reconnoissance by automatic means was the object sought for, and the apparatus not only gave warning of the passage of troops from afar, and unseen by the operators, but also indicated the different branches of the arms in movement, and furnished an approximate idea of the numbers of men and horses on the advance. The contrivance, which is as simple as it is ingenious, consists of a sounding plate buried in the soil, across and along any route, and connected by a long wire to the conductor and receiving disk of the apparatus in position, which provides the electric current to vivify the sound. Generals Vincendon and De Sonis, accompanied by a numerous staff, watched the operations, and were sufficiently impressed by their utility and efficacy in giving warning, that a report was sent to the Ministry of War upon the subject. Orders have been sent to the inventor to continue his experiments under technical superintendence.

The Marine Brake.

A marine brake has been invented by M. Pagan, and was recently tested on the Seine. It consists of a cable having attached to it a series of canvas cones which open out by the action of the water, and exert an enormous retarding force on the vessel. Thus the steamer Corsaire, running at a speed of 13 knots, was stopped by this appliance in 7 seconds, 34 seconds being required when she stopped by reversing the engines without making use of the brake.

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THE PROJECTED TUNNEL BETWEEN FRANCE AND ENGLAND.

The bill to authorize Sir Edward Watkin and his associates to proceed with the construction of the proposed great tunnel under the English Channel, from Dover to Calais, was recently again brought up in Parliament. It has been defeated before this. On this last occasion Mr. Gladstone made a strong and able speech in advocacy of the measure, by which the railway systems of England would be directly connected with those of the Continent, and the vast populations of Europe brought into direct communication with London. The advantages of this tunnel to Great Britain are so obvious that it is difficult to understand why the enterprise should be so bitterly opposed. But Mr. Gladstone's eloquence proved unavailing. The measure was not only defeated by a large majority, but the great orator was looked upon almost as a traitor to his country for publicly upholding and advocating the bill.

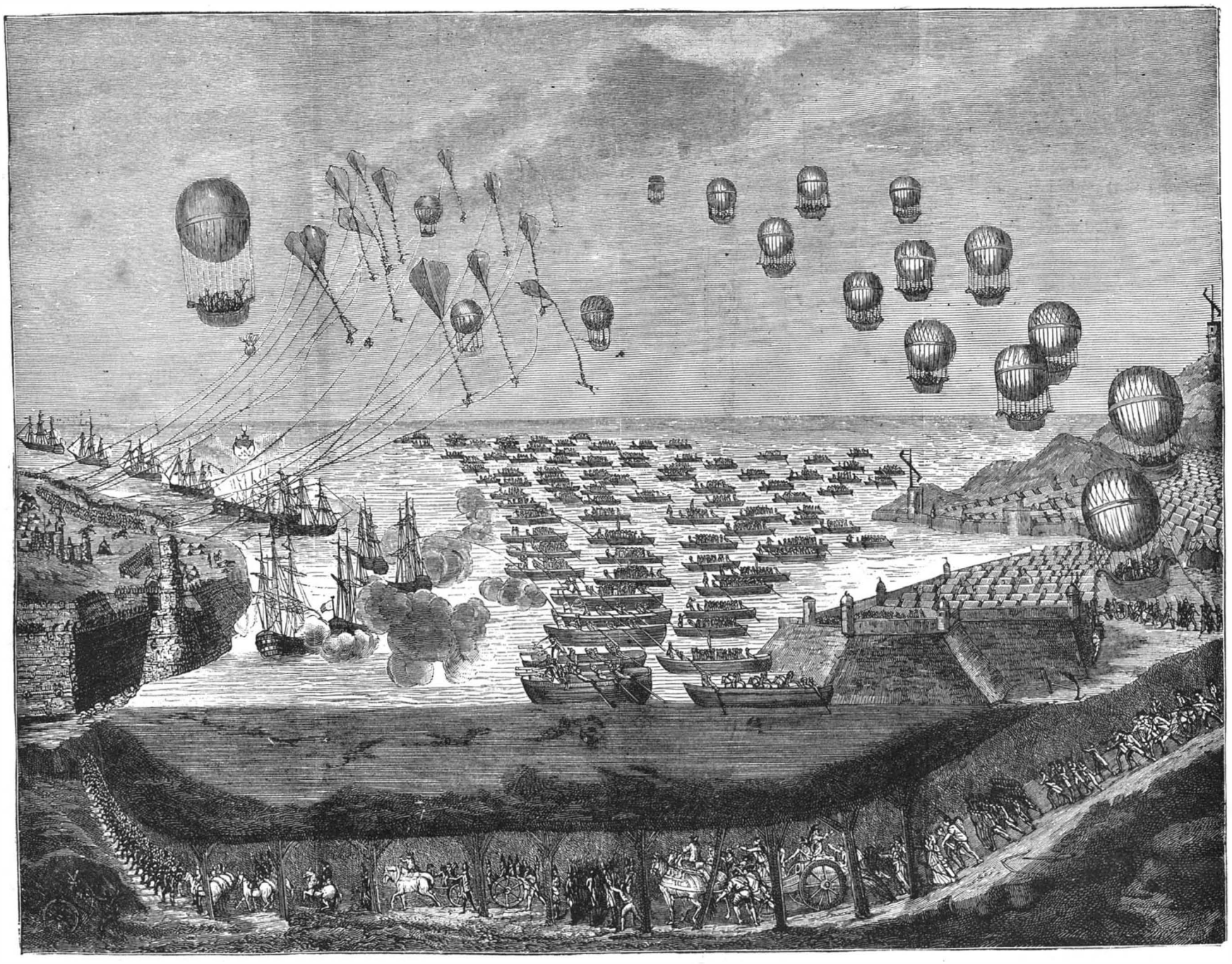
It is now nearly ten years since the preliminary borings for this tunnel were undertaken on both sides of the Channel. On the French side, near Calais, the borings were carried down vertically and then out under the Channel for a considerable distance, far enough to show the practicability of the scheme. On the English side, near Dover, very extensive borings were inaugurated, and a preliminary tunnel, in all some two or three miles in length, was bored out under the Channel. In our SUPPLEMENT, No. 330, we gave a series of illustrations of this tunnel and the machinery by which it was cut.

What then is the real reason why the English are so greatly opposed to the consummation of this work? There is but one answer, *fright*. They are mortally afraid of a French invasion. This fear dates from the time of Napoleon, in 1801, and the British have not yet got over it. In that period, it will be remembered, great preparations were made by the Little Corporal to cross the Channel and subjugate Britain. A dread of the possible success of the attempt struck deep into the hearts of the Britishers, and still lingers with them. It was at this time the tunnel was first proposed and the ease of its construction brought intelligently before their eyes. They were made to see, pictorially, the awful cohorts of the French wheeling and running in absolute security through the bowels of the earth right into the heart of England; and they have never forgotten the terrible scare.

We reproduce from the London *Graphic* a copy of one of the old prints of 1801, in which not only war vessels, but the Channel tunnel and war balloons, were shown as brought into action for the nefarious purpose of invading Great Britain.

The London *Graphic* says:

"During the long war between England and France, which raged, with two brief lulls, from 1793 to 1815, two serious preparations were made for the invasion of England. The first of these was in 1801, when Boulogne, and every other harbor along the coast, was crowded with flat-bottomed boats, and the shores covered with the camps of the men who were designed to fill them. The second and more serious attempt was made in 1803–4, when the war recommenced after the short breathing time granted by the peace of Amiens. At this time, Boulogne being pitched upon as the principal port of embarkation, its harbor and roads were made capable of containing two thousand vessels of various descriptions. As the engraving which we have reproduced bears no date, we are unable to say to which of these two periods it refers, but that which makes it interesting at the present time is that it (jokingly, of course) embodies the conception of a Channel tunnel. It will be observed that the military operations on the water and in the air partake of the nature of a feint. The real business is being done underground. The artist little thought that a time would come when such a scheme would be seriously contemplated, and when its realization would be prevented, not by engineering difficulties, but by fears on the English side of the strait. It is quite possible that, if the Gladstonian party return to office, Sir Edward Watkin will be allowed to carry out his pet project. Sincerely do we hope that that day may be far distant, for the tunnel will practically continentalize England, and, in case of war with France, will greatly lessen the difficulty of invading our shores. If the Dover end were seized by a *coup de main*, the French would have a tube at their disposal through which they might pour 100,000 men into Kent."



FRENCH PROJECTS FOR THE INVASION OF ENGLAND IN THE TIME OF NAPOLEON BONAPARTE, A. D. 1801.

Facsimile of a print published about 1801. It is interesting as showing how old is the idea of the Channel Tunnel. It will be seen that while the French are making feints both by sea and in the air, the main attack is being delivered through the tunnel, of the existence of which the English are supposed to be ignorant.

The British Parcel Post.

Parcels not exceeding seven pounds are now received at any post office in the United Kingdom for transmission to the Argentine Republic and Chili, *via* Germany. Parcels for the Argentine Republic and Chili will be included in the mails for Hamburg dispatched from London every Wednesday, Thursday, and Saturday morning. From Hamburg parcel mails are dispatched to the Argentine Republic every Thursday, and to Chili every alternative Monday. The parcel post is already in operation to Algeria, Ascension, Austria-Hungary, Azores, Barbados, Belgium, Beyrout, British Guiana, British Honduras, Bulgaria, Canada, Cape of Good Hope, Ceylon, Colombia, Congo Free State, Constantinople, Corsica, Costa Rica, Cyprus, Danish West Indies, Denmark, Dutch East Indies, Egypt, France, French colonies and possessions, Germany, Gibraltar, Grenada, Heligoland, Holland, Hong Kong, India (including Aden and Burma), Italy, Jamaica, Labuan, Leeward Islands, Luxemburg, Madeira, Malta, Natal, Newfoundland, New South Wales, North Borneo, Norway, Portugal, St. Helena, St. Lucia, St. Vincent, Sarawak, Servia, South Australia, Smyrna, Spain, Straits Settlements, Sweden, Switzerland, Tangier, Tasmania, Tobago, Trinidad, Tunis, Victoria, West Coast of Africa, Western Australia, and Zanzibar, and is about to be extended to Greece and Mauritius. That is the way the British government helps its export trade in small articles.

New Hudson River Bridge.

A bill was introduced in the United States Senate July 2 to authorize the construction of this bridge. The bill authorizes James King McLanahan, Jordan L. Mott, Henry Flad, Charles J. Canda, James Andrews, Thomas F. Ryan, Gustav Lindenthal, and William F. Shunk to construct a bridge near New York City across the Hudson River. The bridge is to consist of a single span, 140 feet in the clear above the level of ordinary high water. No pier is to be erected between the principal piers of the bridge. The bridge is to be begun within a year and completed within ten years after the approval of the bill, unless there is unavoidable delay by reason of legal proceedings.

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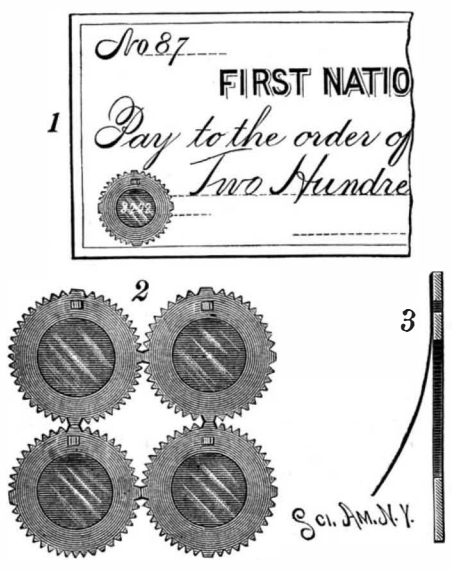
A SAFETY SEAL FOR CHECKS, BONDS, ETC.

A specially devised seal, for application to the face of checks, bonds, notes, and other documents, to prevent altering or changing the figures showing the amounts for which the papers stand, is illustrated herewith, and has been patented by Miss Anna M. Woodhull, of Freehold, N. J. It is made of any proper kind of paper for such purposes, and preferably cut out by dies to such shape as shown in Fig. 2, the seals having serrated edges and being delivered from the die in sheets, the several seals of the sheets being united by narrow webs. The dies also cut out the central portion of each

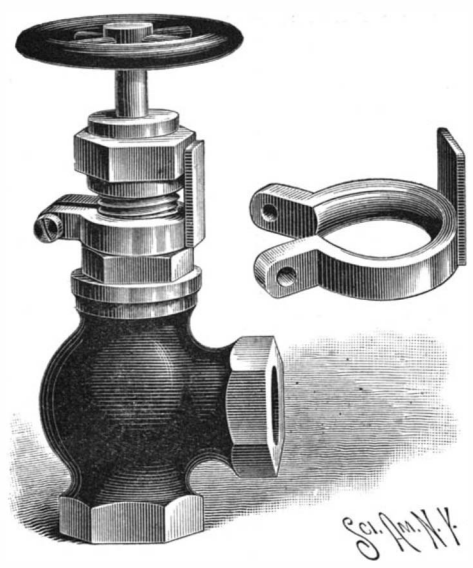


WOODHULL'S SAFETY SEAL FOR CHECKS.

seal to leave a central aperture and a small auxiliary aperture at the side or top. The under faces of the seals are coated with any proper gum, and to each seal there is attached a semi-transparent flap, as shown in Fig. 3, such flap covering the apertures, but being disconnected from the main portion of the seal. When the number to be protected is written upon the check or other instrument, the seal is applied so that the number will be discernible through the semi-transparent flap, as shown in Fig. 1, and the check and the flap of the seal may be pierced through the side aperture of the seal, by a penknife or other convenient means, after the seal has been applied, so that any removal of the seal would direct the attention of the payee to the fact that the amount called for might have been changed or altered.

AN IMPROVED NUT LOCK FOR VALVES.

A device which is adjustable and attachable on a valve casing, and that will securely maintain a packing nut against unscrewing under the turning of the valve stem, is illustrated herewith, and has been patented by Mr. William H. Van Wart, of Stonington, Conn. The tubular neck of a valve casing usually receives upon its exteriorly screw-threaded end an apertured packing nut or gland, between the inner side of which and the end of the neck of the valve casing a suitable packing is employed to make a tight joint. Around a portion of the valve neck, or some other part of the valve, is placed a strap, yoke, or ring, such as shown in the small figure, the ends of which have lugs or ear pieces, through which a thumb or set screw is passed, to draw the ring



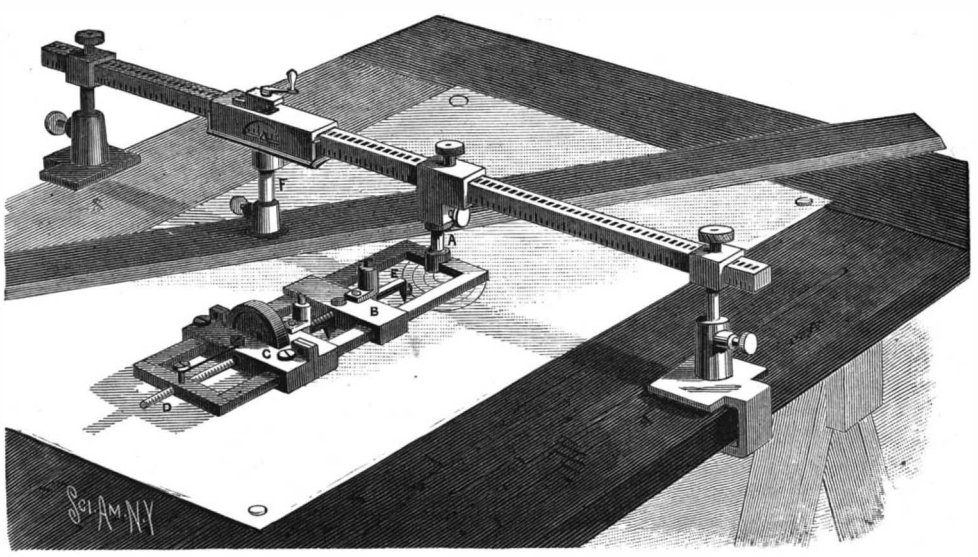
VAN WART'S NUT LOCK FOR VALVES.

to a more or less contracted circumference, and thus firmly bind it against rotation, the strap also having a rigid angular or outward extension adapted to engage one of the flat faces of the rim of the packing nut, preventing the unscrewing of the latter. The patent also provides a modified construction for valves of large size, in which the strap is made in two members hinged together, whereby a certain and easy adjustment and attachment may be secured on the valve casing.

AN IMPROVED DRAWING INSTRUMENT.

An improved instrument especially adapted for drawing section lines, and having an attachment by which ellipses, spirals, and other geometrical figures may be readily produced, is illustrated herewith, and has been patented by Mr. B. F. Hardaway, of Fort D. A. Russell, Wyoming Territory. The clamping posts of the instrument are secured by a set screw, or other suitable device, to the edges of a drawing board, and in each post is adjustably held a vertically sliding rod, these rods supporting above the drawing board a bar having a graduating index on one of its faces. On this bar slides a sleeve, on which is formed a downwardly extending rod, F, to which is adjustably secured a ruler, the sleeve having a pointer in an opening through which the graduation on the bar can be seen, while on top of the sleeve is mounted to rotate a vertical shaft, having on its outer end a crank arm, and on its inner end a bevel gear wheel, the latter meshing into a bevel gear wheel fastened on a shaft revolving horizontally, and formed with a worm meshing into a rack secured to the top of the bar held above the drawing board. The ruler is adjusted at the desired angle on the paper by means of the set screw, and, after the drawing of a line, is moved along any desired distance for the next line, by means of the crank arm extending from the top of the sliding sleeve, such distance being readily read on the graduation scale of the bar, while a device for taking up lost motion insures the holding of the sliding sleeve exactly at the desired point. After the second line is drawn, the operator again turns the crank arm the same distance as before, for making the lines all equidistant, or the distance is varied by turning the crank arm more or less.

The spiragraph attachment is connected with the bar supported above the drawing board by a sliding sleeve, a set screw screwing in the sleeve against the top of the bar, while in the sleeve is held to slide vertically a rod, A, in the lower end of which is held to turn between collars a rectangular frame, having sliding carriages, B C, the former being secured at its middle to one end of a screw rod, D, which passes loosely through the middle of carriage, C, and through the end bar of the frame, to which it can be secured by a screw. The carriage, C, is adapted to be secured to the side bars of the frame at any desired place by set screws, and on each of the carriages is held a drawing pen, as shown at E, so mounted as to be readily held in or out of contact with the paper on the drawing board whenever desired. In the middle of the carriage, C, is mounted a wheel with screw-threaded hub, the threads of which engage those on the screw rod, D, the wheel resting firmly on the paper on the drawing board, and an elastic band, secured by one end to the carriage, C, and by its other end to the end bar of the frame, tends to draw the carriage outward. To draw a parallel spiral, with uniform distances between its coils, the operator places the carriage, B, with its pen directly under the axial line of the rod, A, fastening the other carriage to the frame, with its pen out of contact, and then turns the frame on its fulcrum on the rod, A, whereby the rotation of the wheel in the carriage, C, imparts an outward sliding motion to the screw rod, D, moving the carriage, B, outward, with its pen drawing a spiral, as the frame is pushed around on its fulcrum. To draw a spiral which continually diverges, the carriage, B, is removed from the frame, the carriage, C, placed with its pen under the axial line of the rod, A, and the screw rod, D, secured at its outer end by the set screw to the end bar of the frame, when, by pushing the frame around its fulcrum, an outward sliding motion is imparted to the carriage, C, by the engagement of the screw-threaded axle of its wheel with the screw rod, which motion becomes more rapid as the carriage moves further outward, the wheel making more revolutions in each passage around as its distance from the axial point increases.



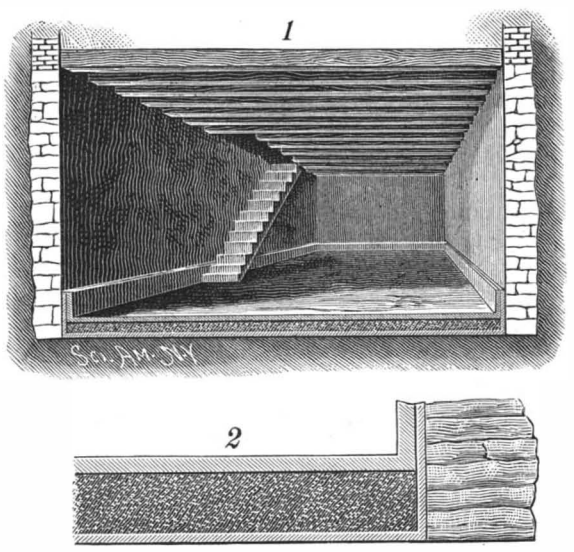
HARDAWAY'S PARALLEL RULER WITH SPIRAGRAPH ATTACHMENT.

Central Pacific.

The Central Pacific has ordered one hundred new locomotives within the last few months, and is building some heavy ten wheel locomotives at the Sacramento shops. The engines have an extended front and straight stack, and weigh 111,500 pounds in working order. Fifteen hundred 34 foot freight cars, of 50,000 pounds capacity, have been added to the equipment lately, 1,000 box and 500 flat cars. The standard rail now used weighs 60 pounds per yard.

A WATERPROOF LINING FOR CELLARS.

A waterproof lining adapted for use beneath pavements in cellars and engine rooms, and similar places, and also in mines and tunnels, has been patented by Mr. Frank J. De Borger, and is illustrated herewith. At the bottom of the cellar excavation is placed a watertight casing, composed of plates of metal, united to form a continuous bottom, and vertical side walls, to fit against the regular masonry walls. Upon this casing is placed a layer or bed of gravel, sand, or dry earth, as shown in the sectional view, Fig. 2, and upon this is laid the usual floor, of cement, wood, or brick,



DE BORGER'S WATERPROOF LINING FOR CELLARS.

with vertical walls to the height of the walls of the metal casing.

For further information relative to this invention, address Mr. T. F. Neville, No. 67 William Street, New York City, or Mr. Frank J. De Borger, Babylon, L. I., N. Y.

Collecting Diatoms.

In an interesting article in the *Bulletin of the Torrey Botanical Club*, Mr. C. Henry Kain discusses the "Diatoms of Atlantic City and Vicinity." Speaking of the bright brown patches of diatoms frequently seen covering the surface of mud, he recommends that they be collected in the following manner: Half fill a bottle with water. Touch one of these brown patches lightly with the tip of the finger, and the diatoms will adhere; then place the finger over the mouth of the bottle and shake. The diatoms are, of course, washed off and remain. By repeating this process again and again, the water finally becomes quite brown. By the time the collector reaches home the diatoms will have settled to the bottom, and the water may be poured off and the diatoms cleaned. It is worth while to examine under the collecting lens every promising patch of brown mud, for very pure gatherings of quite different species may often be collected within a few feet of each other.

The Death of Cleopatra.

Dr. Viaud Grand-Marais, of Nantes, has been holding an inquest on the sudden death of Cleopatra. He rejects the theory that her death was caused by the bite of a viper. She was accustomed to test the effects of various poisons on her slaves, in order to ascertain which caused the easiest death. Having shown that no viper was found in the room of the fair suicide, that her body presented no traces of bites, and that her two maid servants were found dead or dying at the foot of her bed, he comes to the conclusion that her death was caused by carbonic oxide.—*Bulletin General de Therapeutique.*

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A Ship of Logs.

We are familiar with the log cabin, but a ship made of logs is something of a novelty. Such a vessel has lately been built in Nova Scotia by Mr. Leary, the owner of the great timber raft that was lost at sea last year. The new log ship is shortly to be launched, and will then sail for New York. Finges Board, N. S., is the little village where the curious boat is now located.

It is constructed of 30,000 logs, varying in size from a pine tree 200 feet long to a short spar 25 feet in length. These logs are placed together in the shape of a ship's hull, and they are firmly bolted, besides being lashed into a compact mass with thirty-five tons of wire rope. The ship is 700 feet long—nearly as long as the Great Eastern—and 65 feet broad and 35 feet deep. It draws about 22 feet of water. All the inside logs are in the rough, but built about it all is a shell of thick, smooth planks, coming to a sharp point at the bow with a heavy cutwater. The bows are very full, and running aft to the waist the ship widens to 65 feet. From there aft the lines follow those of a clipper ship. Six spars about 70 feet high are built into the ship to serve as masts. Five of these masts will be fitted with a heavy yard, which will be rigged with a big square sail. The mizzenmast will be fitted with a spanker. The masts will carry an immense spread of canvas.

The logs are laid in tiers lapping over one another, the whole resting in an enormous cradle built of spiles. A massive chain runs through the center of the logs for its entire length. This chain is made of welded iron, the links being 1¾ inches thick. Aft, a distance of 10 feet, are cross chains, with links 4 inches long and 3 inches wide. These run in all directions, and are clamped on the outside by cross arms of wood. The towing line will be attached to the main chain, and the transverse chains are so arranged that the draught on the main chain binds the whole mass together in a grip that will make it next to impossible for it to go to pieces. The greater the strain on the main chain, the tighter the raft will be held together. Still further precautions are taken by the use of thick wire rope, which will be bound about the logs midway between each cross chain. The raft will thus be bound together by chains and steel wire at every five feet. The mass will be almost as solid as the trunk of a tree. Its weight is estimated at 20,000 tons.

Should the towing steamer, through any cause, drop the ship, the sails will be used to keep steerage way. It is claimed that the driving power of the sails will be sufficient to sail the ship, but this is doubted by sailors. The sails will also be spread whenever the wind is favorable, using them as an auxiliary to the steam power. A comfortable deck house has been built aft for the shelter of the crew, which will be made up of fifteen able-bodied seamen. The New York *World* says the log ship will be towed by the powerful ocean tug M. B. Morse. The Morse has been thoroughly fitted out for the voyage. With favorable winds, Mr. Leary expects the log ship to make the run to New York in seven days. A straight course will be laid from the Bay of Fundy to Long Island Sound.

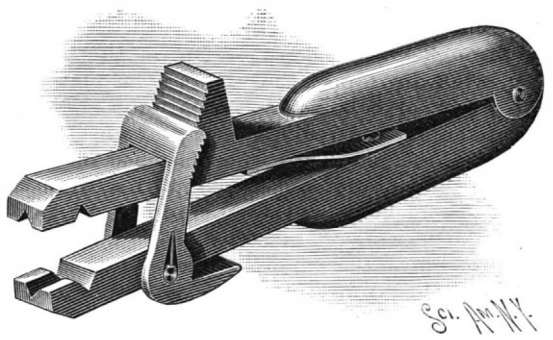
The timbers of the ship, if sawed on the Bay of Fundy, would require a fleet of 100 schooners to transport them to New York. Vessel owners are very antagonistic to the scheme, and the Legislature will be appealed to for the purpose of having a law enacted to prohibit the building and sailing of such craft. The owners of hundreds of schooners and other small vessels that bring lumber from Canada on their return voyages are also bitterly opposed to the shipping of heavy logs in bulk, as the log ship, if successful, will destroy their trade. Dealers who depend on the railroads will also be utterly unable to compete with the lumber brought by the raft. It would take fifty trains of fifty cars each to transport the lumber contained in Mr. Leary's log ship.

The ship will be launched this month, at a time when the tide is highest in the Bay of Fundy. At that time 100 feet of the ship will be in the water, and the supports will be knocked away and the enormous fabric slide gracefully into the water. The cost of this log ship, if landed successfully in New York, is as follows: The timbers cost in Nova Scotia $13,000; the towage will cost $100 per day. The logs can be sold in New York for $50,000.

THE steamer Greenwood, plying between Portland and Peak's Island, is the pioneer boat in electric lighting in that section of the country. The Greenwood is 14½ tons burden and carries 150 to 200 passengers. The "plant" consists of a small upright engine, a dynamo constructed from drawings in the SCIENTIFIC AMERICAN SUPPLEMENT, and eleven lamps. The side lights are 10 candles each, and the head light and one on top of flag staff 16 candles each. The remainder are 10 and 16 candle lamps. The lamp on the stern flag staff stands upright on the top of the same, and shows finely at night. Everything works well, and all agree that the lights are a great improvement over lanterns.

AN IMPROVED WRENCH.

A wrench which may be readily closed to fit a nut or other object, but cannot be opened except by releasing a pawl, is illustrated herewith, and has been patented by Mr. Richard L. Mabrey, of Doniphan, Mo. The head ends of the wrench bars have V-shaped transverse notches on their inner faces, and to the lower bar is pivoted a bail-shaped pawl, the cross bar of which overlaps and engages the upper arm. To insure a proper engagement between the pawl and the upper arm of the wrench, the latter is formed with a lug having a serrated edge, the cross bar of the pawl being also serrated. The pawl has a handle at its lower edge, by



MABREY'S WRENCH.

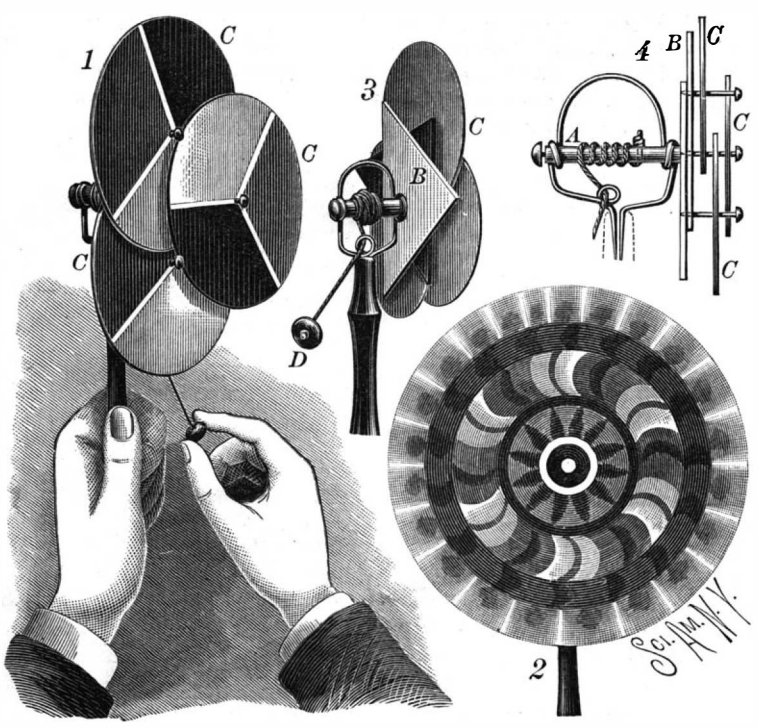
which it may be moved out of engagement with the serrations of the wrench bar, in which it is normally held by a spring secured to one of the studs on which the pawl is pivoted.

NEW CHROMATROPE.

We give an engraving of a novel toy which illustrates some of the phenomena of color. Upon the spindle, A, is secured a star, B, formed of two triangular pieces of pasteboard arranged so that their points alternate. One triangle is red, the other green—complementary colors—which produce white when they are blended by the rotation of the star. In the angles of one of the stars are secured wire nails, which serve as pivots for the three disks, C, as shown in Figs. 1 and 4. Each disk is divided into three equal parts, which are colored respectively red, blue, and yellow. The disks overlap at the center of the star, B.

Around the spindle, A, is wound a cord which passes through the loop formed in the star frame in which the spindle is journaled, and is provided at its end with a button, D. By pulling the cord, the star, B, is whirled first in one direction and then in the other. As the series of disks, C, turn, the colors are blended in different ways according to the relative arrangement of the different sections. All the phenomena of the blending of surface colors are illustrated by this simple toy. At times the center will be a beautiful purple, while the outer part is green. At other times some portions of the color disk presented by the rotating disks are white, showing that a proper mixture of the three primary colors yields white light.

At the instant of the change of rotation from one direction to the other, the arrangement of the disks is such as to present beautiful symmetrical figures. All



TOY CHROMATROPE.

the changes of color in the toy in its normal condition are, of course, accidental.

When it is desired to try the blending of any of the colors, when arranged in a particular way, the disks may be prevented from turning on their pivots by stretching over each disk a small rubber band.

The maker of this simple toy has succeeded in securing colors which produce remarkably good effects.

Fast Ships Wanted in the British Navy.

Although utterly unfit to fight at close action with a belted ship, and running many risks of destruction from raking and other fire, the Blake and Blenheim, by virtue of their enormous speed, 22 knots, will be valuable additions to the naval service, and it is a satisfaction to know that at last we are to have two very fast ships of some sort to outstrip in speed the existing seagoing vessels of every other country. Sir Edward J. Reed draws attention to the waste of public money which has taken place and is in contemplation in the production of ships of insufficient speed. He states his object in drawing attention to them is to show how unwise our experience shows it to be to lay down vessels of a speed which cannot be useful for war purposes, should war arise. I am afraid that the same error is about to be repeated, but I wish to take the sense of naval officers on the question, and to ask them whether, looking to the utter disproportion of our fast cruisers to the services which will be required of them in war, it is or is not wise to go on lavishing money in this way upon vessels not a single one of which reaches a 15 knot speed, and most of which are to be of only about 13 knots at their very best, which means only about 10 knots in regular sea service. In view of the mighty interests concerned, and of the fact that at present £140,000,000 worth of our imports are food, it is incumbent upon all of us to do the best we can to face and to assist in solving the problem of its protection. One effectual way of doing this will be to get all the money allowed by the country and Parliament for the purpose spent upon efficient and speedy ships.—*Captain Colomb.*

Mummies from Mexico.

In the Ethnological Department of the California State Mining Bureau are now on exhibition four mummies, which form the subject of a paper by Dr. Winslow Anderson in a recent bulletin published by the Bureau. These interesting remains were discovered by Signor S. Marghieri on the eastern face of the Sierra Madre Mountains, Mexico, in a cave, the mouth of which had been so skillfully sealed with adobe plaster and natural rocks from the mountain as to almost escape detection. At the extreme end of this natural sepulcher these bodies—a man, woman, little boy, and infant girl, of which no inscriptions or other evidences exist to reveal their race—had been placed with faces turned toward the rising sun. No artificial means of preservation had been employed. They were simply wrapped in burial shrouds, woven of various materials, cotton, hair, and grasses, and their mummification had been brought about by the natural action of the extremely dry atmosphere of that region, which prevents decay. They have dried in the sitting posture, with hands crossed and knees drawn toward the chin, and are remarkably well preserved, the brain, heart, lungs, abdominal and pelvic viscera being intact, and dried to a solid consistency.

The man is large and well developed, with a large head and broad shoulders, but has small hands and feet, with high arched instep. The woman is even better preserved. A heavy suit of hair still remains. Her hands and feet are small, the latter measuring only 8½ inches in length, and her skull gives unmistakable evidence of a high degree of intelligence. The facial angle of the man is 71 degrees and of the woman 69 degrees. The skull of the little boy, who is supposed to have been about seven years of age, is unusually well shaped, and indicative of no meager mental capacity, and the facial angle is 71 degrees. These cranial features are superior to those of the inhabitants of the same region to-day. Moreover, the hair of the woman is soft, silky, and brown in color, wholly unlike that of the Indian races. In some respects these bodies approach the Aztec type; but, whatever the race may have been, it was one of superior development. The mummies were secretly transported from Mexico, to avoid trouble with the superstitious Indians of that locality, and were purchased by Mr. J. Z. Davis, who presented them to the California State Mining Bureau.

A Colorado Line of Two Feet Gauge.

The experiment of building a railroad of two feet gauge was undertaken a few years ago in Massachusetts, but the road (the Billerica and Bedford) was not a financial success, and the rails and rolling stock were removed and laid down in Maine, where a line of some length is now in operation. The first road of this miniature gauge in the West has just been opened in Colorado, running some ten miles from Black Hawk into a mountain mining region. The average grade is about 190 feet to the mile, reaching in some places as much as 264 feet; and curves as short as 90 degrees are operated. The largest locomotive, with tender loaded with fuel and water, weighs only 20 tons, and another is half that weight. This little road carries a good deal of ore, and is expected also to develop a considerable excursion traffic.

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Correspondence.

Waterproof Sand Paper.

To the Editor of the Scientific American:

Can you tell me how to make a waterproof sand paper; something that will stand as much use wet as ordinary sand paper will dry? It need not necessarily be like sand paper, but of any substance that would answer the purpose. The cost of the material would not be of as much importance as the fact of being able to get something to answer the purpose. W. H. T.

Freeport, Ill.

A Well 10,000 or 20,000 Feet Deep.

To the Editor of the Scientific American:

Before the meeting of the present Congress, a statement was made that a proposition would be submitted by some one for the appointment of a committee or commission to have a *well bored into the earth some* 10,000 *or* 20,000 *feet deep*. I have searched through the proceedings of Congress, and so far have failed to find evidence that any action has been taken on the subject. When the matter was first broached, it seemed like a wild scheme and of little importance; but like the introduction of many inventions—the telegraph and telephone for example—it may develop into one of the utmost importance. Who can tell what vast secrets of nature may be discovered? And what great results may come from the experiment? May we not find means by which heat and power, of unlimited extent, can be found? When the best minds of the country are seriously studying how to find means to use the surplus money now in the treasury, may not a portion of it be asked for this purpose to advantage? In conclusion, I would ask you to urge Congress to make an appropriation to the War Department to enable it to have a well bored at least 10,000 or 20,000 feet deep. C. A.

Philadelphia, Pa.

Gas Threads.

To the Editor of the Scientific American:

I notice an answer in your "Notes and Queries" column to C. H. F. about gas threads, and as these threads seem to be a puzzle to all apprentices, a sealed book to most amateurs, and often a bother to the full-blown engineer, I give you here a table of the English threads, along with the diameter. The English threads, be it understood, have very little taper, just sufficient to bite when a coupling or a flange is screwed home, and are cut to an angle of 55°. The table is as follows:

DIAMETER OF GAS TAPS—"WHITWORTH."

Size. In.	Dia.	Dia. at bottom of thread.	No. of threads per in.
⅛	0·3825	0·3367	28
¼	0·518	0·4506	19
⅜	0·6563	0·5889	19
½	0·8257	0·7342	14
⅝	0·9022	0·8107	14
¾	1·041	0·9495	14
⅞	1·189	1·0975	14
1	1·309	1·1925	11
1⅛	1·419	1·3755	11
1¼	1·65	1·5335	11
1⅜	1·745	1·6285	11
1½	1·8825	1·766	11
1⅝	2·021	1·9045	11
1¾	2·047	1·9305	11
1⅞	2·245	2·1285	11
2	2·347	2·2305	11
2¼	2·5875	2·471	11
2½	3·0013	2·8848	11
2¾	3·247	3·1305	11
3	3·485	3·3685	11
3¼	3·6985	3·582	11
3½	3·912	3·7955	11
3¾	4·1255	4·009	11
4	4·339	4·2225	11

ERNEST W. NAYLOR.

New York, June 27, 1888.

Scarlet Fever.

To the Editor of the Scientific American:

I notice in your issue of July 7 an article on "Contagious Diseases," in which the writer states that scarlet fever "is produced by a specific poison, which emanates from the person of the patient, and can be caused by no other means."

During a period of 54 years in Baltimore, 1830 to 1883, inclusive, scarlet fever caused 12,197 deaths, equal to a yearly average of 226, 334 having occurred during the latter year; and during that year our city council passed an ordinance regulating plumbing, which took effect January 1, 1884, the result of which, in the reduction of the mortality from scarlet fever, has been remarkable. During 1884, 104; 1885, 68; 1886, 32; 1887, 36—a total for four years of 240, equal to a yearly average of only 60 deaths. Was not the great mortality from scarlet fever during the 54 years prior to our plumbing ordinance caused in a very great measure by defective plumbing? We think so.

Diphtheria for seven years prior to our ordinance, 1877 to 1883 inclusive, caused 3,289 deaths, equal to a yearly average of 469. Since the ordinance has been in force the yearly average has been 234, or a total of 934 deaths for four years. We are strong advocates of sanitary plumbing.

A. R. CARTER, Health Department.

City Hall, Baltimore, July 9, 1888.

The Number of Men Engaged in the American Iron Trade.

We may state that at the outstart we have no figures later than those of the census of 1880, although they may be used as the basis of some estimate, as follows. The census figures were:

	Product 1880. Net tons.	Men employed.
Pig iron	3,781,021	41,875
Iron rolling mills, including nail	2,353,248	80,133
Bessemer and open hearth steel works	983,039	10,835
Crucible steel works	75,275	5,196
Forges and bloomeries	72,557	2,939
Total	7,265,140	140,978

For the year 1887 the following estimate may be made covering the same ground:

	Product 1887. Net tons.	Estimate No. of hands same proportion.
Pig iron	7,187,206	80,126
Iron rolling mills	2,588,500	89,000
Bessemer and open hearth steel works	3,433,491	37,840
Crucible steel	84,421	5,820
Forges and bloomeries	43,306	1,750
Total	13,336,924	214,536

From this probably at least 10 per cent must be deducted to allow for the fact that a greater output is being made with less labor in all departments of the iron trade, and notably in blast furnace work. This would leave it roughly 193,000 hands in the iron and steel works themselves.

The quantity of iron ore used in 1880 was as follows:

	Tons.
Blast furnaces	7,256,684
Rolling mills	363,959
Bessemer and open hearth	7,327
Crucible	2,128
Forges	79,610
Total	7,709,708

The number of hands employed in mining 7,064,829 tons of iron ore in the census year was 31,668. The output for 1887 is estimated at 11,300,000 tons, which would indicate a force of 50,600 hands.

In 1880 the consumption of anthracite coal by furnaces and rolling mills was 3,222,498 tons. In 1887 it must have been at least 4,000,000 tons. In 1880, 70,748 hands produced 28,621,371 tons of anthracite, which would indicate 10,000 men for the iron works fuel in 1887. In 1880 the furnaces and rolling mills consumed 5,659,055 tons of bituminous coal. Taking into account the fact that the steel works used relatively little coal, and that natural gas is widely employed, the fuel consumption of 1887 may be roughly estimated at 5,000,000 tons. In 1880, 41,850,054 tons of bituminous coal gave employment to 100,116 men. We would have 12,500 men for the above quantity. Allowing for the introduction of coal cutting machinery, etc., it may be put down at 10,000 men.

In 1880, 3,142 men were employed in producing 5,359,489 tons of coke, of which 2,277,555 tons were consumed in iron works. In 1887 the consumption was probably not short of 6,000,000 tons, which would call for 3,500 men engaged in the labor of converting coal into coke. The number of men employed in mining the coal for the coke may be roughly estimated as follows: Taking 63 per cent as the yield of coal when making coke, 9,500,000 tons of coal would be required, which would call for about 20,000 men. Then there are at least 2,000 men employed in quarrying limestone and over 1,000 in making charcoal. We thus make the following total as a rough estimate:

	Hands.
Furnaces and rolling mills	193,000
Iron ore mining	50,600
Anthracite coal	10,000
Bituminous coal	10,000
Coking coal	3,500
Mining coal for coke	20,000
Quarrying limestone	2,000
Making charcoal	1,000
Total	290,100

It is safe to say that in raising the raw material from the ground and manufacturing into merchantable products the iron trade gives employment to about 290,000 men. This does not include any of the force employed in water or rail transportation. It does not embrace the wire mills, pipe works, foundries, boiler shops, bridge and structural iron shops, etc.—*Iron Age.*

How to Use the Telephone on Submarine Cables.

At a recent meeting of the Paris Academie des Sciences, a note of M. Ader on the use of the telephone as a receiving instrument for submarine cables was read. If a telephone is placed at the extremity of such a cable while signals are being transmitted, these signals cause absolutely no sound in the telephone, because, though the diaphragm is put in motion by each signal, the vibrations are too slow to be perceived by the ear, which only recognizes a sound when the vibrations exceed about twenty per second. If, however, the telephone is connected to the cable through a vibrator, the number of vibrations may be increased to any extent and the signals through the line be easily distinguished. With the dot and dash system there is no difficulty in reading by the telephone, the differing durations of the sound being easily perceived; but for the rapid working of cables it is found advisable to work with alternating currents, and in this case some method of distinguishing in the telephone between positive and negative currents must be adopted. This is done by making use of two instruments, one applied to the left and the other to the right ear, the natural tones of the two telephones being different. Both these instruments are connected to the vibrator, and through it to the cable. Each separate telephone circuit is, however, traversed by another current from a local battery, which passes through one circuit in a positive direction and through the other in a negative, the vibration being included in both circuits. The strength of this current is adjusted to be equal to that from the cable, and hence when, say, positive currents are being sent, the local current in one telephone is annulled, while in the other it is increased, and that telephone alone sounds, and when negative currents are sent the reverse takes place, the other telephone sounding, and in this way the signals can easily be distinguished.

Char in Sugar Refining.

At a recent meeting of the Society of Chemical Industry, London, a paper by Messrs. B. and J. Newlands was read upon "The Mode of Using Char in Sugar Refining." The paper set forth that the charcoal used in experimenting was not new, but had been used for some time in sugar refining. New charcoal would not get rid of the color in the sugar solution. Dried blood and horns give a charcoal of great decolorizing power for oils and fats, but not suitable for sugar refining. For the latter, a charcoal is required which is both hard and porous, and one which adheres strongly to the tongue; when the charcoal is not sufficiently hard, it causes inconvenience by the production of dust. The following table shows the amount of dust produced after each sample of charcoal had been revolved 672,000 times, and then sifted:

	Size of sieve.	Dust produced per cent.
English charcoal (No. 1)	10 to 20	2·560
" " "	20 to 30	2·560
" " "	40 to 50	3·220
" " (No. 2)	20 to 30	1·414
" " "	30 to 40	3·694
" " "	40 to 50	8·720
Russian charcoal	8 to 10	3·878

Most refiners like a "small grist" char, since it is most efficacious in decolorizing sugar, and the following table gives the results of experiments on that point. The amount of reduction of color in each case was determined by means of a photometer:

Size of sieve.	Proportion of color remaining.
Char 10 to 20	5
" 20 to 30	4
" 30 to 40	3·5

Original color, 23·0.

The higher the temperature within certain limits, the better are the decolorizing results:

Temperature, Fahr.	Proportion of color remaining.
100	64
125	58
150	46
175	32
200	32

Original color, 420.

Time is a matter of importance, and six hours gives the best results in the case of cane sugar. Beet sugar is better with longer contact. The authors had obtained the following results in time experiments with three descriptions of sugar:

	Jamaica.	Natal.	88 Nat. beet.
Original color	660	420	23

Proportion of Color Left.

Hours.	Jamaica.	Natal.	88 Nat. beet.
2	102	60	6
4	92	37	5½
6	60	28	5
8	64	29	4½
10	—	30	—

The coloring matter which char abstracts from sugar can be dissolved out of the char again by alkaline solutions; consequently, the char does not act by destroying the coloring matter by peroxide of hydrogen or any other oxidizing agent.

The absorption of air by freshly burnt bone charcoal goes on for a considerable time; for if some freshly burnt charcoal be put in a bottle, and turned out of it a few days afterward, a thermometer then put in the mass will rise 20° or 30° F., showing that absorption is going on. In sugar refineries the char after use is washed with once or twice its weight of water, and then recalcined in closed cylinders. At first steam is driven off from it, and this steam is utilized for the drying of wet charcoal. "Buchanan's Improved" kiln is one of the best forms of pipe kilns for revivifying charcoal.

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TEMMINCK'S CHELYDRA.

Among the turtles that inhabit ponds or rivers, and that Dumeril and Bibron have arranged in a particular family under the name of Elodites, although their organization differs little from that of land turtles, one of the most interesting is undoubtedly Temminck's chelydra (*Chelydra Temminckii*), for which Agassiz established the genus *Gypochelys*.

The species, of which the menagerie of the Paris museum has two fine specimens, makes itself at once remarked by its huge head, which is very wide at the temples, but decreases rapidly in front and terminates in a pointed snout at whose extremity are situated the nostrils. The eyes are large and brilliant and are surrounded with a row of small, hard protuberances that project over the iris. The jaws are armed with a horny facing, sharp upon its free edge and particularly strong. The upper overlaps the under, and the two, in moving, constitute a formidable pair of shears. The upper jaw ends in front in a strong median vertical hook, followed by a rounded groove, an arrangement that recalls the beak of a vulture. A similar hook is observed on the lower jaw, but it is covered by the preceding and nestles in a small cavity in the upper jaw. Under the chin there is a pair of wattles.

The neck is stout, and is covered with a wrinkled, rugose skin, which is dotted with warty projections that often terminate in horny spines. This skin does not adhere to the subjacent tissues, and is so loose that it forms a sort of sheath into which the neck can withdraw by bending behind under the vertebral column in order to take a position under the carapax. Under such circumstances, the head seems to be directly supported by the body, and this is the state that is represented in the engraving, and that in which the animal habitually remains, although the head itself at times almost entirely disappears. But, let prey or enemy present itself within reach, and the neck suddenly straightens under the action of peculiar protractive muscles, and the head is thrust out in front on the object attacked, which is at once seized between the animal's powerful jaws.

The carapax is wide, oblong, and quite depressed, and is traversed by three longitudinal ridges. Its front edge is excavated above the neck, while the posterior is denticulated. The plastron is narrow and cruciform, and is immovable. The fore legs are strong, and the toes, which are connected by a flexible membrane, terminate in strong claws, that are five in number on the fore feet, but four only on the hind. The tail, which is long and thick, especially at the base, is covered with a warty skin and three rows of oval plates, one on each side, and one on the median dorsal line. The plates of this latter row stand out so as to resemble a discontinuous dorsal crest.

The carapax, neck, and top of the head are of a somewhat dark brown, but the plastron and a large portion of the jaws is of a pale yellow.

The animal seems to live to a very advanced age. Of the two specimens owned by the museum, one has been in captivity for eleven years, and the other for nine, and their size, which is very large, has not perceptibly increased during that time. The carapax of one of them is 24 inches in length by 20 in width at the broadest part, and, when the neck is entirely hidden beneath the carapax, the distance from the snout to the end of the tail is four feet.

The chelydras are peculiar to North America. The species under consideration is met with chiefly in the Mississippi and its affluents, as well as in some of the other rivers that empty their waters into the Gulf of Mexico. The museum specimens both came from the Mississippi. They usually keep themselves entirely submerged and immovable at the bottom of the tank in which they are placed, with their snouts directed obliquely upward. From time to time they slowly lift their heads and stick their noses out of the water to get a fresh supply of air, and then disappear again. They are frequently observed to expel from their nostrils a stream of water, which is made manifest on the surface by the uplifting and disturbance of the liquid. But whence comes this water, from the stomach or the lungs, and what is its role? These are questions that are yet to be solved.

The diet of the chelydras is essentially flesh. In a state of liberty they live chiefly upon fish, but they do not disdain aquatic birds, which they seize with their powerful jaws and drag under water and drown, and afterward feed upon. In captivity they content themselves with meat or fresh fish, and rats or kittens previously killed. Their regimen doubtless has an influence upon their character, which is savage and fiery to such a point that, according to reliable authors, they become furious when irritated. What is certain is that the first feeling provoked by the chelydra when it is examined at the bottom of its tank, the snout raised and the eyes fixed, is one of distrust; and this feeling increases in intensity when it is reflected that its huge head, which seems to be soldered to the body, can, by a rapid motion, be thrown forward the entire length of the neck. The anatomical arrangement that allows it to pull its neck back under the carapax and afterward to extend it like a spring is, for it, the equivalent of a trap that it can use at will, and that it keeps constantly set for its victims. One other circumstance renders it more dangerous still; as it usually keeps entirely motionless in the water, a parasitic vegetation develops upon its carapax, and covers it in such a way that it is difficult to distinguish it from surrounding objects. This is the case with the museum specimens, which disappear under a thick stratum of confervæ.

Despite its savage nature, Temminck's chelydra lives on good terms with another species of the same genus, the *Chelydra serpentina* (the common snapping turtle), which does not attain so large a size, but the disposition of which is more ferocious and the character more treacherous, as its specific name indicates. In a state of liberty, it falls upon everything it meets, and does not fear to attack and profoundly wound those who chance to bathe in the watercourses that it inhabits.

The chelydras are capable of swimming in water with agility, but upon land their movements are slow and uncertain. So they scarcely adventure upon it except for the purpose of laying their eggs. The eggs of the snapping turtle, which are laid to the number of twenty or thirty, and are relatively small, are, it appears, much sought for; but the flesh of these animals exhales a strong odor of musk and is not edible.—*La Nature.*

CHELYDRA TEMMINCKII.

The Weymersch Battery.

The Weymersch electric battery is of the Bunsen type, the difference between the two lying in the depolarizing fluid. In the Bunsen cell this is nitric acid, but it has not yet been announced what it is that Mr. Weymersch uses. Whatever it is, it effects, says *Engineering*, a most remarkable improvement in the constancy and output of the battery, and raises it to the front rank among this class of electric generators. According to tests made by Messrs. Alabaster, Gatehouse & Co., on five cells, each measuring 8¼ in. by 8¼ in. by 12 in., and containing an inner porous cell measuring 7¼ in. by 1½ in. by 12 in., having within it, in addition to the carbon electrode, 3¾ pints of depolarizing fluid, the electromotive force on open circuit was about 9·26 volts for the whole series, and 5·70 volts on a closed circuit in which the current was adjusted by resistances to 10·1 amperes. At the expiration of 31½ hours' continuous working the electromotive force had only fallen to 8·95 volts on open circuit and 5·65 volts on closed circuit, the current being 10 amperes. During the whole run the free potential did not vary more than about three per cent. The working electromotive force was practically the same at the end of the test as at the beginning, and the current only varied between 10 and 10·6 amperes. The actual consumption of zinc was only 10 per cent in excess of the theoretical amount. The internal resistance of the battery varied between 0·057 ohm and 0·070 ohm per cell.

THE directors of the Panama Canal Company fixed June 26 for the issue of the lottery loan. There are to be 2,000,000 bonds at 360 francs, bearing 15 francs interest, and repayable within ninety-nine years at 400 francs. There will be six drawings a year till 1913, and afterward four. Three of these drawings will each have a prize of 500,000 francs, the other three each a prize of 250,000 francs, besides smaller prizes, the aggregate of the annual prizes being 3,390,000 francs. The prizes and redemption will be guaranteed by a deposit of French rentes.

THE new mill of the Holyoke Envelope Company is nearly completed. The boilers have a capacity of 200 horse power. There are 64 envelope machines, with a producing capacity of about 3,000,000 envelopes a day, where the greatest amount of work turned out in one day was 1,860,000 envelopes. The building has 900 water sprinklers and 18 stands of pipe, together with a huge water tank holding 6,000 gallons.

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IMPROVEMENTS IN THE CABLE RAILWAY OF THE NEW YORK AND BROOKLYN BRIDGE.

(*Continued from first page.*)

ing one or the other of the engines into gear with the cable drums, as required. The entire traffic of the railway has been carried on by means of 3-car trains, propelled by these engines through the medium of the cable.

Since the completion of the bridge, the growth of the traffic has been so regular and so rapid as to render apparent the necessity of increasing the carrying facilities. In April, 1884, 752,220 passengers were carried over the bridge. In April, 1888, 2,593,104 passengers were carried. If the traffic were evenly distributed through the day, the 3-car trains could readily carry the passengers for some time to come; but, as is well known, the traffic varies greatly with different hours of the day. For example: in the hour beginning at 8 o'clock in the morning, from 10,000 to 12,000 people are carried from Brooklyn to New York, while less than 1,000 are carried from New York to Brooklyn. In the hour beginning at 5 o'clock in the afternoon, from 9,000 to 10,000 people are carried from New York to Brooklyn, while only about 1,500 are carried at the same hour from Brooklyn to New York. In the middle of the day the average in either direction is about 2,000 per hour, and at midnight scarcely more than one-tenth of that number.

This enormous traffic exceeds the original expectations, and the great and abrupt fluctuations of power required to propel the trains at these busy hours have severely tested the engines. One day's record showed that the power ranged from 303 h. p., as a maximum, to 12·9 h. p. negative, as a minimum. We are informed of one instance in which there was an increase of 190 h. p. within 15 minutes, and another in which the power was increased by 239 h. p. within 30 minutes.

To provide economically for the present traffic, to anticipate future increase, as well as to provide for various improvements which have been developed by conditions peculiar to this particular railway, and to guard against any suspension of traffic by any possible accident to a part of the machinery, a new driving plant has been constructed and put in operation.

The old machinery is located in one of the arches of the approach adjoining the Brooklyn station. The engines of the new plant are contained by a substantial brick building adjoining the north side of the approach, and abutting against the boiler house. In this building are placed three magnificent engines, built by William Wright, of Newburg, New York. They are of the girder type, of graceful design and elegant finish. These engines are placed parallel with each other, and arranged to be coupled independently with the cable drums. They are of three sizes; the largest one (625 h. p.), for propelling the trains at night and morning, has a cylinder 30 inches in diameter, with a stroke of 48 inches; the next in size (400 h. p.) has a cylinder of 26 inches in diameter, with a stroke of 48 inches; the smallest one (275 h. p.) has a cylinder of 22 inches in diameter, with a stroke of 36 inches. The fly wheel of the largest engine is 20 ft. in diameter, and weighs 50,000 lb.; the fly wheel of the next is 20 ft. in diameter, and weighs 40,000 lb.; and the fly wheel of the smallest engine is 15 ft. in diameter, and weighs 16,000 lb. The smallest engine is connected with the driving shaft by means of gearing and clutches; the larger engines are connected direct by means of clutches.

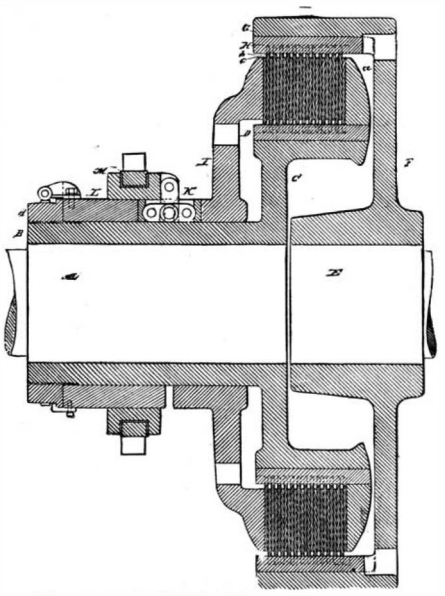

Fig. 3.—LONGITUDINAL SECTION OF FRICTION CLUTCH.

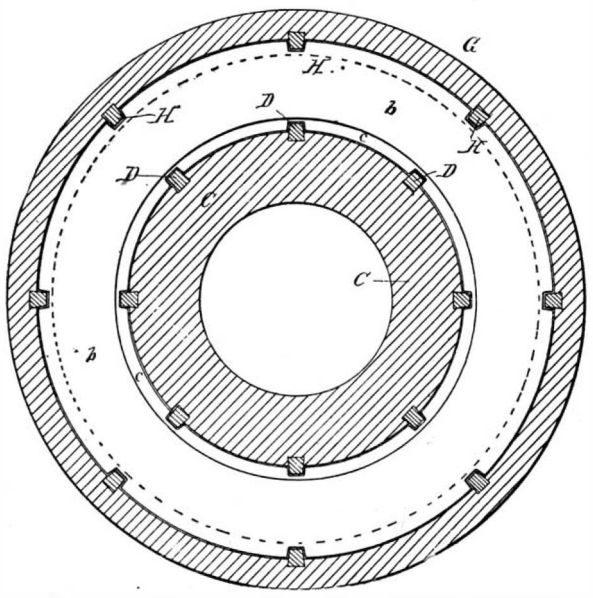

Fig. 4.—DIAGRAM SHOWING RELATION OF CLUTCH RINGS AND HUBS.

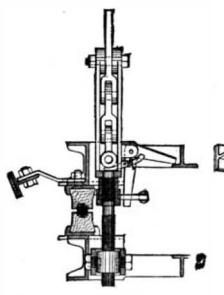

Fig. 8.—CROSS SECTION THROUGH VISE GRIP.

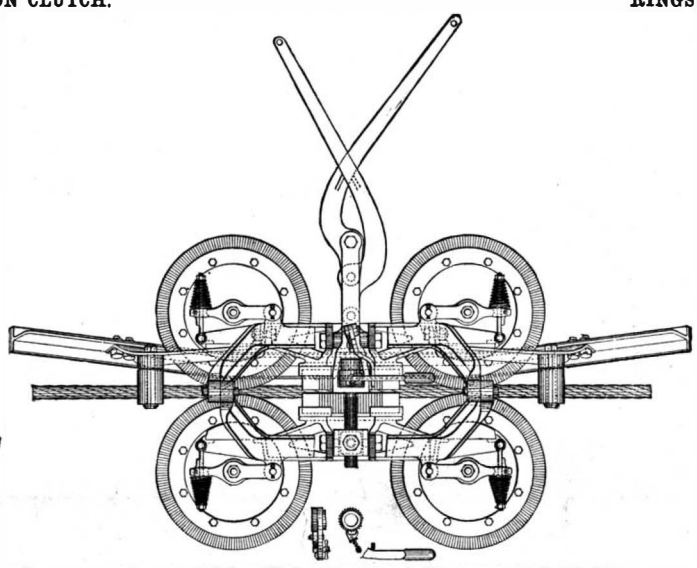

Fig. 6.—INVERTED PLAN VIEW—DETAILS OF GRIP.

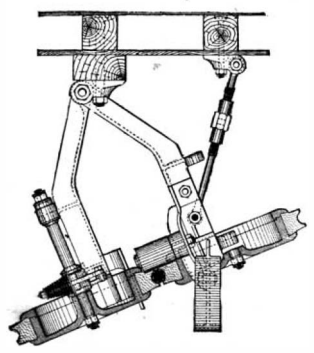

Fig. 7.—SECTION THROUGH SHEAVES.

The driving shaft is made in sections, and arranged to be connected by jaw clutches and friction clutches, so that either of the engines may be brought into connection with either pair of cable drums. Each engine is provided with a friction clutch by which it may be thrown into engagement with the driving shaft while the cable and driving machinery is in motion, so that the engines may be shifted without loss of time.

One of these ponderous clutches is shown in Fig. 2. In the foreground of the picture may be seen the usual column and throttle valve wheel for starting and stopping the engine; also another wheel arranged upon a hollow shaft inclosing the throttle valve spindle, and connected with the clutch-operating mechanism. The operation of shifting the engines consists in starting the engine by means of the throttle valve in the usual way, and when the engine attains its normal speed, throwing in the clutch by means of the clutch-operating wheel, then disconnecting the clutch of the engine to be taken off.

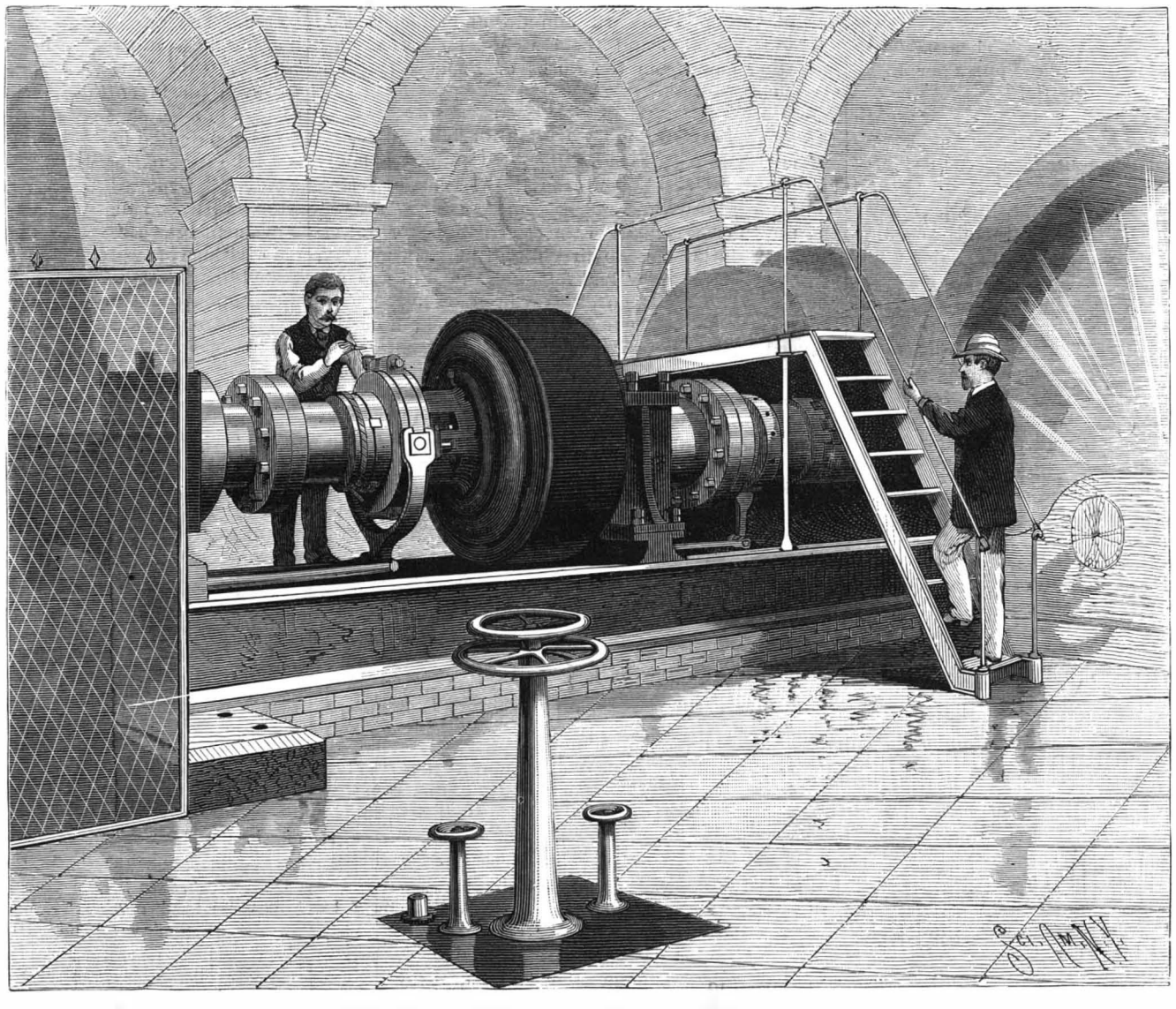

Fig. 2.—NEW CABLE DRIVING PLANT, NEW YORK AND BROOKLYN BRIDGE—THE FRICTION CLUTCH.

The details of the friction clutch are shown in Figs. 3 and 4, Fig. 3 being a longitudinal section of a clutch and Fig. 4 a diagram showing the relation of the clutch rings. To the engine shaft, A, is attached a sleeve, B, provided with a hub, C, which supports the friction rings, *b c*, the hub being provided with a flange, *a*, forming an abutment for the friction rings. In the hub, C, are inserted eight feathers, D. The rings, *b c*, are of two diameters, the rings, *b*, of smaller diameter being slotted to receive the feathers, D. The rings, *c*, which are of larger diameter, are slotted in their peripheries to receive eight feathers, H, inserted in the rim, G, of the hub, F, secured on the shaft, E. By this arrangement, it will be noticed that all of

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the rings, *b*, must turn with the hub, F, and all of the rings, *c*, must turn with the hub, C.

Upon the sleeve, B, is placed a clamping collar, I, which is capable of being forced into contact with the series of rings, *b c*, clamping them tightly against the flange, *a*.

On the sleeve, B, is placed a sleeve, L, which abuts against an adjusting ring, *d*, screwed on the end of the sleeve, B. The sleeve, L, forms an abutment for toggles, K, three in number, which serve to force the clamping collar, I, into contact with the rings, *b c*. On the sleeve, L, is placed a grooved ring, M, arranged to work the toggles, K, and in the groove of the ring, M, is placed a strap, which is connected through a system of levers with the clamping wheel before referred to. A is the driven shaft, E the driver. When the toggles, K, are loosened, the shaft, E, turns independently of the shaft, A; but when the toggles are straightened, bringing the friction rings, *b c*, into forcible contact with each other, the shaft, E, will carry the shaft, A.

The capacity of the clutch is increased by increasing the number of the rings, *b c*. The clutch for the large 625 horse power engine has 27 rings, the clutch for the 400 horse power engine has 19 rings, and the clutch for the 275 horse power engine has 13 rings.

To guard against every possible emergency, all the important parts of the machinery have been made in duplicate. There are two sets of driving drums, two cables, one in motion and the other in reserve. The cable running out from the engine house passes over the deflection sheaves around sheaves carried by the tension car, thence outward, and the incoming or hauling end of the cable passes around a set of deflection sheaves, thence downward underneath the upper floor of the Brooklyn station to a large sheave revolving in a horizontal plane, and shown in Fig. 5, thence back to the propelling drums. The second cable, which is held in reserve, passes around an extra set of propelling drums, and is supported near the sheaves, in readiness to be transferred to them in case of necessity. The transfer of cables requires about one hour, and while it is being done the trains are carried over the bridge by locomotives.

The grip now used is shown in Figs. 6 to 8 inclusive; Fig. 6 being an inverted plan view, Fig. 7 a section through the sheaves, and Fig. 8 a central cross section.

In the grip there are four sheaves placed in pairs, so that the cable is gripped between each pair. Each sheave has a heavy grooved rim with a cylindrical inner surface against which the brake presses. The rim is in two parts bolted together, and holds in a dovetail groove a packing of leather and India rubber belting in alternating pieces placed radially. The packing projects well out of the rim, and is grooved to receive the cable.

There are four brakes, one for each sheave. They are made of hard wood, with a curved outer face fitted to the inside of the rim of the sheave.

The main frame of the grip is in two parts, each hinged in a common line parallel to the cable, close under the car floor, one part hanging on each side of the cable. The sheaves are each carried by a small frame hinged to the main frame, on a line parallel to the shaft of the sheave. This small frame has a limited movement opposed by a coiled spring which tends to force the sheave away from its brake. Each of the four brakes is held by a projecting end of the main frame. The upper part of the main frame, from which the operating levers project, is fixed in position by adjustable stay rods. The movable part is connected to the operating levers by a coarse-threaded screw which is turned by a ratchet wheel and pawl.

As the grip is used the packing in the grooves of the sheaves is slowly compressed and worn, thereby permitting the sheaves to come more nearly together as the grip is closed, and the short arms of the operating levers approach more closely to a straight line, and as this continues, the pressure on the packed surfaces increases rapidly. Such action is prevented, when, as the grip is closed, a certain position of the levers in approaching each other is passed, by the pawl engaging with the tooth of the ratchet wheel, then, as the levers are separated, the screw is turned slightly, bringing the sheave surfaces and levers to their former and normal relative positions. As the grip is closed and the sheaves are brought into contact with the cable, they are revolved at cable speed, the car being at rest. As power is applied to the brakes, the sheaves are forced together with an increasing pressure, which is transmitted from the brakes to the sheaves, developing a frictional resistance which tends to prevent the sheaves from revolving. This action continues until the resistance in the four sheaves exceeds the tractive resistance of the car, when the sheaves cease to revolve and the car moves at cable speed.

The vise grip (which grasps the cable only as the frames and sheave packing yield) is intended to take full hold after the sheaves cease to revolve and the car is moving at cable speed.

To the frame holding the grip is applied an inverted rail, which comes into contact with flat-faced pulleys on the tilting frames of the sheaves which support the cable. This inverted rail causes the movable sheaves to hold the cable at the proper height to be received by the grip. The packing of the grips and sheaves forming the contact surface for the cable is made of alternating pieces of leather and India rubber. The packing is cut by machinery and the pieces are put together under pressure. The composite nature of the packing allows the leather to swell when moist and to shrink when dry, the elasticity of the rubber keeping the packing in proper shape.

Besides the hand brakes with which each car is provided, there are vacuum brakes operated by connection with reservoirs carried by the cars and exhausted of air by pumps operated by the eccentrics on the car axles. The brakes have proved very efficient, the vacuum being readily maintained by the pumps.

In the reconstruction of the propelling plant of the bridge great credit is due to Mr. C. C. Martin, chief engineer and superintendent, and to Mr. G. Leverich, assistant engineer, who have given to every detail of the new plant the utmost care and attention. Nothing has been omitted which would increase the efficiency of the machinery. On the other hand, nothing has been introduced that is without a practical bearing. The

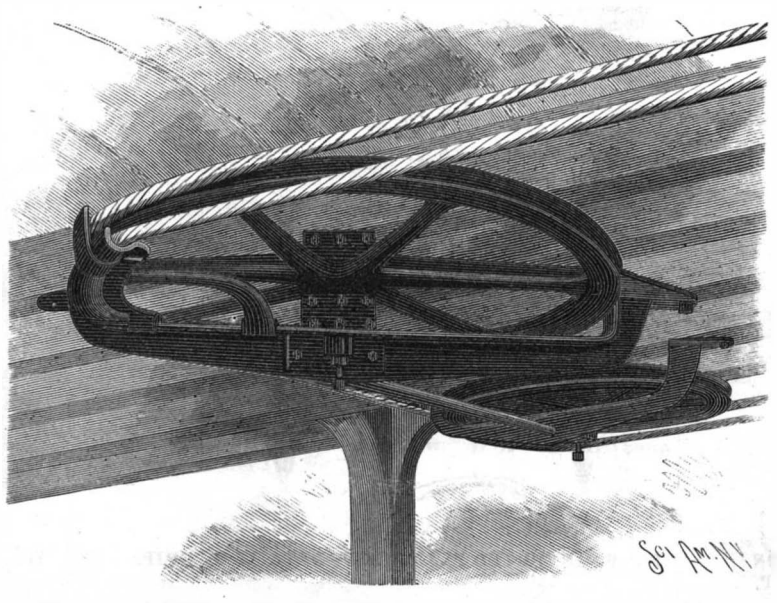

Fig. 5.—DEFLECTION SHEAVES AND AUXILIARY CABLE SUPPORT.

entire work has been done from plans and specifications furnished by the engineers. The engines were made by Mr. Wm. Wright, of Newburg, N. Y., as already stated. The cable drums and machinery are from the works of the Southwark Foundry and Machine Co., Philadelphia, Pa., and the clutches, including their operating gear, from the works of Poole & Hunt, of Baltimore, Md.

Electric Lights of Fishing Nets.

The Liverpool Marine Biology Committee lately made a three days' tour around the coast of Wales. The important feature of this cruise, says *Nature*, was the use which was made of the electric light for collecting after dark. On the first night, in Ramsey Bay, after the shore party had left and the ship was anchored for the night, an electric light of 1,000 candle power was hoisted a few feet above deck, and this allowed work to be carried on almost as comfortably as during the day. Captain Young, of the Liverpool Salvage Association, who was in command of the Hyæna, then kindly arranged for me a 60 candle power Edison-Swan submarine incandescent lamp in the mouth of a tow net. This illuminated net was carefully let down to a depth of three fathoms, and allowed to remain there for half an hour. At the same time another tow net without any light was let down to the same depth over the opposite side of the ship. When the nets were being hauled in, as the one with the electric light approached the surface, numerous small animals (crustacea probably) were noticed accompanying it, and darting about in the bright light. This tow net, when emptied into a glass jar of sea water, was found to contain an abundant gathering, consisting mainly of crustaceans, while the net in the dark on the other side of the ship had practically nothing.

The two nets were then put out again. The one had the electric light in its former position, but this time it was let down to the bottom at a depth of six fathoms, while the other net was placed in the dark at the ship's stern, and also reached the bottom. The tow nets remained stationary, but were kept distended by the tide. The outline of the illuminated net could be made out indistinctly at a depth of six fathoms. After being out for three-quarters of an hour, both nets were hauled in, with the same result as before. The illuminated net contained abundance of crustacea (chiefly amphipoda, schizopoda, and cumacea), while the dark net again contained practically nothing. These two experiments showed pretty conclusively the effect of the brilliant light in attracting the free swimming animals, the difference between the contents of the two nets being on both occasions most marked. Consequently, on the second night, in Port Erin Bay, both nets were illuminated, and while the one was let down close to the bottom, at a depth of five fathoms, the other was kept at the surface of the sea on the opposite side of the ship. This experiment was tried three times, with the same result each time; both the nets were found to contain abundance of animals, but the bottom and surface gatherings differed greatly in appearance and in constitution. The net from the bottom contained mainly large amphipoda and some cumacea, while the gathering from the surface was characterized by the abundance of copepoda.

Brief History of Timepieces.

At a recent meeting of the Balloon Society of Great Britain, an address was given by Mr. James Kendal on "The British Watch Industry." The lecturer stated that the sun dial of Ahaz is the first record of a timekeeper, that the obelisks of the Egyptians were intended as gnomons, and that the next record of a sun dial was the hemicycle of the Chaldean astronomer Berosus, 459 B.C. The clepsydra, or water clock, was the next contrivance for measuring time, used by the Chaldeans; but to whomsoever the early discovery of timekeepers may be due, he said that clocks were set up in churches as early as 1174, and in the reign of Henry VI. a pension was granted to the Dean of St. Stephen's for taking charge of a clock in Palace Yard, Westminster. In 1326 Richard Wallingford, abbot of St. Alban's, placed a clock in his monastery which showed the hours, the motion of the sun, the changes of the moon, the ebb and flow of the tide, etc., and the account of this clock is still preserved in the Bodleian Library at Oxford. In 1340 Peter Rightfoot, a monk of Glastonbury Abbey, made a clock which, at the Reformation, was removed to Wells Cathedral, and the original is now to be seen at the South Kensington Museum. The clock for the Strassburg Cathedral was begun in 1352, and finally completed in 1574 by Conradus Daspodius.

The use of the pendulum for securing accuracy of time was first adopted by Vincent Galileo, in 1648, and the anchor escapement, for regulating it, by Dr. Hook, 1666; and he stated that little progress was made since that time until Mr. Dennison, now Lord Grimthorpe, designed the clock for the Victoria Tower of the Houses of Parliament in 1854. The most remarkable episode in the construction of timekeepers is the lever escapement, invented by Thomas Mudge, in 1770, the last epoch in the history of the watch. The progress of the last fifty years in watch making has consisted rather in the perfection of proportions than in the introduction of new principles, for even the invention of winding from the pendant instead of a watch key is tardy appreciation of an invention patented more than half a century ago.

At the International Inventions Exhibition of 1885, Kendal & Dent exhibited a horological novelty of a watch with two dials placed back to back, with the movement between them. On one dial was marked the old divisions of twelve hours, and on the other the suggested hour circle with twenty-four divisions, and this invention attracted considerable attention from horologists and mechanicians. Mr. Kendal then referred to the important uses to which timekeepers are devoted by the use of marine chronometers to enable the navigator to ascertain his longitude as he travels over the sea. In 1714 the English government offered a reward of £10,000 for determining the longitude to within sixty miles, £15,000 within forty miles, and £20,000 within thirty miles; and this reward was secured, after thirty years of unremitting labor, by John Harrison, a carpenter, of Faulby, in Yorkshire, who succeeded, in 1764, in producing the present marine chronometer.

Japanese Water Pipes.

The water supply of Tokio, Japan, is by the wooden water pipe system, which has been in existence over two hundred years, furnishing at present a daily supply of from 25 to 30 million gallons. There are several types of water pipes in use, the principal class being built up with plank, square, and secured together by frames surrounding them at close intervals. The pipes less than 6 in. consist of bored logs, and somewhat larger ones are made by placing a cap on the top of a log in which a very large groove has been cut. All the connections are made by chamfered joints, and cracks are calked with an inner fibrous bark. Square boxes are used in various places to regulate the uniformity of the flow of the water, which is rather rapid, for the purpose of preventing aquatic growth. The water is not delivered to the houses, but into reservoirs on the sides of the streets, nearly 15,000 in number.

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SIMPLE EXPERIMENTS IN PHYSICS.

BY GEO. M. HOPKINS.

The behavior of gases under certain conditions is of peculiar interest to the student of physics, since it involves actions which cannot be seen and which require purely mental effort for their comprehension. There are simple ways of demonstrating that certain actions do occur, but the exact mode of their occurrence is left to reason or conjecture.

In some of the following experiments molecular action proceeds with astonishing rapidity. One of the best examples of this rapid action is the absorption of gases by charcoal.

To illustrate absorption according to the usual method, a piece of recently heated charcoal is floated upon mercury and a test tube filled with carbonic acid gas or ammonia gas is inverted over it and quickly plunged into the mercury. The absorption begins immediately and quickly forms a partial vacuum, which causes the mercury to rise in the tube.

When a quantity of mercury is not available, the experiment may be performed very satisfactorily in the manner illustrated by Fig. 2. A glass tube, closed at one end by a cork in which is inserted a short piece of smaller tube, is plunged open end downward into a tumbler partly filled with water. To a flask or bottle is fitted a cork in which is inserted a small glass tube, and the two small tubes are connected by a short piece of flexible rubber tubing. The flask is filled with carbonic acid gas,* and corked. One or two small pieces

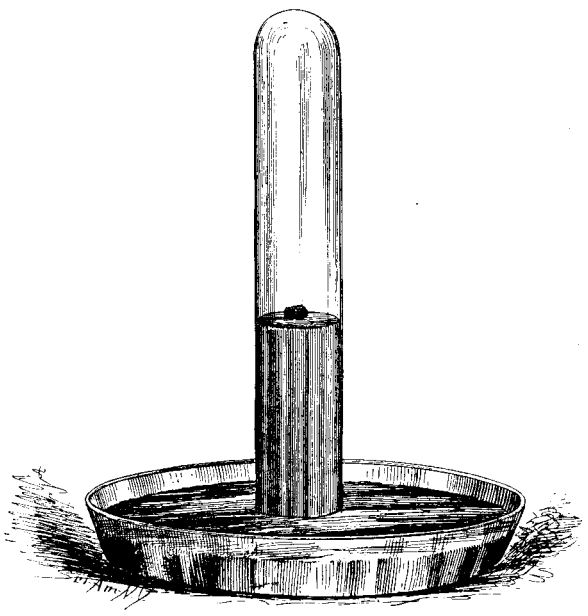


Fig. 1.—ABSORPTION OF GASES BY CHARCOAL.

of fine charcoal are heated strongly in a closed vessel, such as a covered crucible, or upon the top of a stove. The cork of the flask is removed, and the charcoal is dropped in and the cork replaced. If there are no leaks, the absorption of the gas by the charcoal will be immediately shown by the rise of the water in the tube in the tumbler. The coal will absorb 35 times its bulk of the gas. In the case of ammonia the volume of gas absorbed reaches 90 times the bulk of the charcoal. As the gases which are most easily condensed to a liquid state are those which are absorbed with the greatest facility, it is fair to presume that the gases absorbed by the charcoal are in a liquid state. The well known purifying property of charcoal and

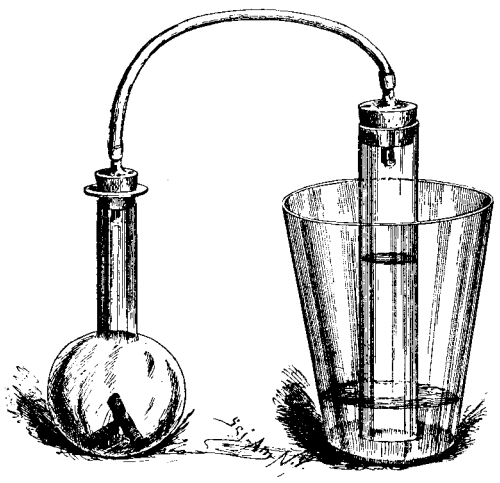


Fig. 2.—ABSORPTION OF CARBONIC ACID GAS BY CHARCOAL.

other porous substances is referred to their absorptive power.

THE DIFFUSION OF GASES.

The tendency of gases to mix or diffuse one into the other is very strong. A simple experiment exemplifying this tendency is illustrated by Figs. 3 and 4.

* Carbonic acid gas for this and subsequent experiments may be readily prepared by dissolving a small quantity of carbonate of soda (say 1 oz.) in water, in a tall glass or earthen vessel, then slowly adding a few drops of sulphuric acid. The gas will quickly fill the vessel to overflowing. The carbonic acid gas being much heavier than air, may be readily poured into the flask.

A clean, dry porous cell, such as is used in galvanic batteries, is closed by a cork in which is inserted a small glass tube. A piece of barometer tube six or eight inches long is connected by rubber tubing with the tube of the porous cell. The end of the barometer tube is plunged into water and the porous cell is introduced into a vessel * filled with hydrogen or illuminating

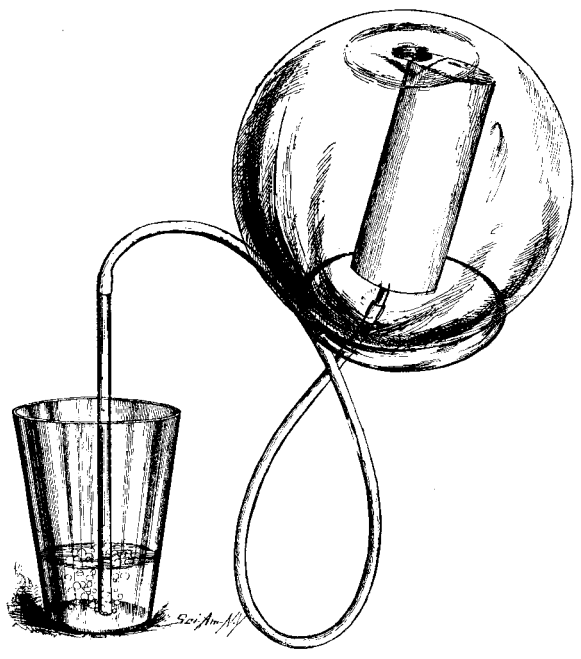


Fig. 3.—THE DIFFUSION OF GASES—ENDOSMOSE.

gas. The gas enters the porous cell so much more rapidly than the air can escape through the pores of the cell that a pressure is created which causes the air to escape through the tube and bubble up through the water.

When the porous cell is removed from the glass globe, the reverse of what has been described occurs, the gas passing outward with much greater rapidity than the air can pass in, thereby producing a partial vacuum, which causes the water to rise to *a* in the glass tube. These are examples respectively of endosmose and exosmose. In these experiments it is of vital importance to have tight joints, as the slightest leak will in-

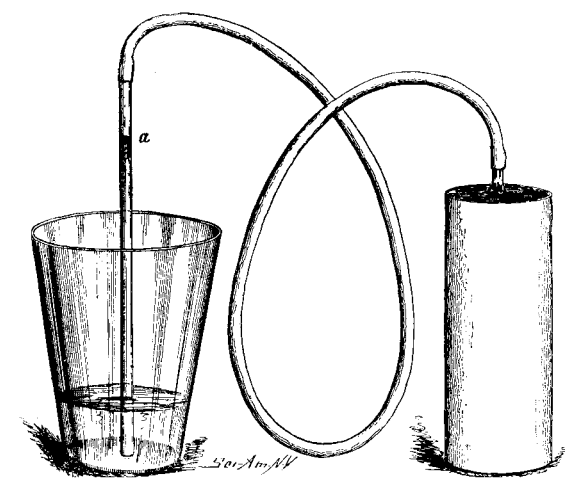


Fig. 4.—EXOSMOSE.

sure failure. The corks should fit tightly, and where they are not to be removed, they should be carefully sealed.

* An ordinary fish globe answers admirably as a gas-containing vessel for this and similar experiments. It is readily filled with illuminating gas by placing it for a few minutes in an inverted position over a burner through which gas is flowing.

Electric Street Cars.

The New York papers a short time ago contained stories concerning an electric shock which Mrs. Lizzie Pfeifer sustained while riding on the electric road from East New York to Jamaica. A gentleman who investigated the case made this report:

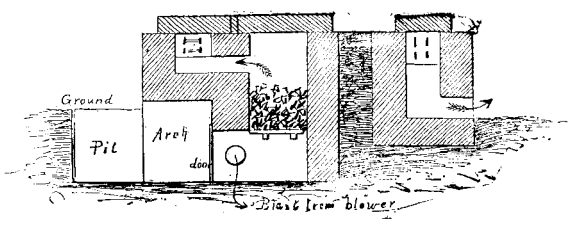
"The electrical circuit from the power station consists of two bare copper wires directly over the tracks, supported by cross wires from ordinary telegraph poles on the sides of the street. These copper wires are connected directly with the dynamo at the power station, and are about fifteen feet above the surface of the street. Two flexible insulated wires run from the motor on each car to two wheels or trolleys resting on the overhead conductors. As the car moves, the trolleys are drawn after it, keeping the motor in constant connection with the dynamo. The current comes from the dynamo through the positive conductor or overhead wire, passes from the trolley down through the motor, up to the other trolley, and back through the negative conductor to the dynamo.

"It is evident that to receive a shock one must be in contact, either direct or through wires, with both overhead conductors at the same time. It is absolutely impossible to receive a shock unless this condition be fulfilled. The motor is on the front of the car, inclosed in a cab, and separated from the rest of the car by a partition. A person sitting in the body of the car could in no conceivable way come in contact with the two overhead wires, and of course could not receive an electric shock. A person in the motor cab might touch the two bare ends of the wires running down from the trolleys, and so complete the circuit through his or her body, receiving a part or the whole of the current; but it is not alleged that Mrs. Pfeifer was in the motor cab, where passengers are not allowed.

"The trolleys on this road are poorly constructed, in consequence of which they sometimes fall from the wires. This is annoying to passengers, but is simply a nuisance, not a source of danger. The fall of the trolley breaks the circuit, and the current is cut off from the motor. No accidental shock can result under such circumstances. It is said that Mrs. Pfeifer was in a highly nervous condition, resulting from a recent surgical operation. The trolley fell, and she was greatly alarmed. On the repetition of the accident she fainted, and was carried from the car in an unconscious condition. She was attended for two hours by one of the employes, who gave me the foregoing information. I have no doubt as to the substantial accuracy of these facts, as the conditions made it impossible for her to receive an electric shock. To the ignorant, electricity possesses many terrors, but it is subject to well defined laws, and a more general understanding of these laws would remove many unreasonable prejudices. The current used on the Jamaica road has a potential of 500 volts. Such a current would produce an unpleasant but by no means fatal shock. The precautions are such, however, that an accidental shock is almost impossible. The lesson conveyed by this accident is not that electric motors and their actuating currents are dangerous to life and limb, but that electric railways should be equipped with trolleys that would not fall off to the alarm of nervous passengers. Such trolleys are in use on many electric railways of all systems in this country."—*Western Electrician.*

TIRE FURNACE.

The following sketch shows a good tire furnace with a set of tires in place. The tire chamber is circular, with a fire and flue entering on one side below the tires and the exit on the other side, also below the tires.

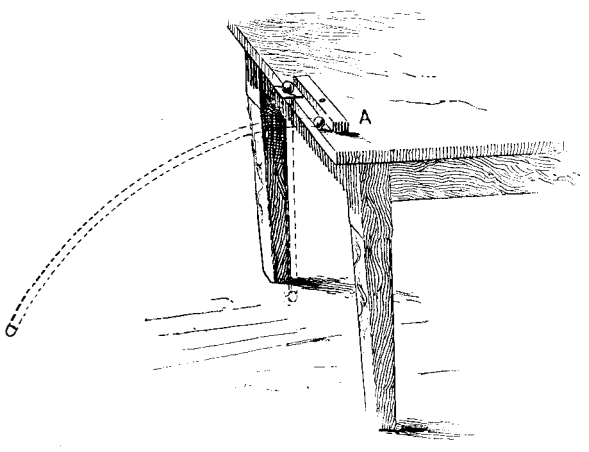


The chamber and furnace covered with fire brick slabs. The whole furnace and chamber should also be made of fire brick. Use coal, as in the sketch. If it is desired to use wood, leave out the grate and door, and arrange the furnace to fire directly under the tire chamber. Extend the exit flue to a short chimney and use natural draught.

SIMPLE APPARATUS FOR ILLUSTRATING NEWTON'S SECOND LAW.

In this journal for March 3 there is described an apparatus for illustrating Newton's second law. The following simple arrangement will project and drop a ball at, practically, the same instant, with equal facility:

A piece of hard wood, 12 inches long, 1½ inches wide, and ¾ of an inch thick, has fastened to one side of it



APPARATUS FOR ILLUSTRATING NEWTON'S LAW.

near the end a piece of tin, 3 inches long and 1½ inches wide, so that one-half of the tin will project edgewise from the stick. Through a hole in the center, fasten the stick loosely, by means of a wood screw, one-half inch from the edge of a table—the tin downward and projecting one inch over the edge of the table. Place a marble on the end of the tin, and another on the table against the opposite end of the stick. The sketch will illustrate the plan. If the end, A, be now struck a smart blow with a hammer, the desired illustration will evidently follow.

J. P. NAYLOR, Indiana University.

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ENGINEERING INVENTION.

A locomotive truck has been patented by Mr. Alonzo C. Packer, of Pittsburg, Pa. This invention provides a center plate supported by springs, the latter held by hangers movably mounted on the main truck frame, the range of movement of the hangers being defined by adjustably mounted stop blocks, the construction being adapted to afford the freedom of movement necessary in car trucks in passing curves.

AGRICULTURAL INVENTIONS.

A hand planter has been patented by Mr. Seth Hackett, of Bronson, Mich. Combined with a handle and ground penetrating and opening points, with a spring-pressed pivoted jaw, is a hopper and seed-dropping disk, with other novel features, whereby the requisite quantity of seed may be deposited in each hill.

A grain or hay stacker has been patented by Mr. Donald McRae, of Umatilla County, Oregon (P. O. address, Walla Walla, Washington Ter.) It is a portable stacker whose main feature is a lever pivoted on an upright, and adapted to be swung both vertically and laterally for the purpose of transferring grain, hay, or straw, etc., from a wagon to a stack.

MISCELLANEOUS INVENTIONS.

A folding paper box has been patented by Mr. David J. Rex, of Pittsburg, Pa. It is formed of a single piece of paper of the requisite thickness, the intention being to reduce the waste to a minimum in the making of a class of boxes which are sold by weight, and especially designed to hold tacks.

A horse detacher has been patented by Mr. George T. Parker, of Glasgow, Ky. Combined with the ferrule having the trace stud is a double-armed stud for forcing the trace off the trace stud, there being a retracting spring operating between the arms of the slide, and a tripper, with other novel features.

A horse detacher has been patented by Mr. William B. Walker, of Nevada, Mo. The bolts to secure the traces and breeching straps are normally held by springs, which are connected to draw lines adapted to be operated by the driver to retract the bolts and release the traces and breeching in case horse or horses attached to a vehicle should run away.

A folding hat and coat rack has been patented by Mr. Gayger D. Tolman, of Shawano, Wis. It has a shelf formed of wire, upon which hats may be placed, side frames hinged thereto, with loops to attach them to nails or other supports, and hooks pivoted to the rear and sides of the shelf, the several parts being made of wire and adapted to be folded up together.

A faucet has been patented by Mr. Edwin P. J. Freeman, of Roslyn, N. Y. It is a hollow metal tap screw-threaded on its outer and inner surfaces, to be screwed permanently into a barrel, with a screw-threaded stopper or plug screwed into the inner end of the tap, and an outer faucet to be screwed in provided with a rod or blade for screwing back the plug.

A lightning escape for wire fences has been patented by Mr. Allin Cockrell, of Lamar, Mo. The fence is constructed with a number of sections, in each of which a single strand of wire is extended back and forward between posts, and has its terminals grounded, so that a stroke of lightning will only affect a portion of the fence.

An auger handle has been patented by Mr. Harry Naylor, of Oil City, Pa. It is formed with a cylinder having openings, in the line of which project a fixed notched cross piece and a rocker clamp adapted to move lengthwise of the handle, thereby holding any sized bit in a straight position, while the shank does not touch the cylinder.

A candy machine has been patented by Mr. George Tschinkel, of Brooklyn, N. Y. It has an endless apron with form plates, in connection with a funnel having apertures in its bottom, a bar sliding in ways, with adjustable rods and plungers, and other novel features, whereby candy may be rapidly and conveniently formed into any desired shape.

A wrench has been patented by Mr. Richard L. Mabrey, of Doniphan, Mo. The head ends of the wrench bars have V-shaped transverse notches on their inner faces, to gripe the nut or other object to be turned, and to the lower wrench bar is pivoted a pawl to overlap and engage the upper arm, and hold the bars in any desired adjustment to properly gripe the nut or bolt.

A windmill has been patented by Mr. Joseph S. Marshall, of Clear Water, Kansas. This invention covers a novel construction and combination of parts designed to afford a windmill which may be manufactured at a low cost, and wherein the parts are so connected that the bolts will not be apt to become loose when the woodwork of the mill is exposed to the action of the elements.

A waterproof composition for floors, walls, etc., has been patented by Mr. Charles V. Mittge, of Brooklyn, N. Y. It is made of cement, cream of tartar, pulverized ivory, quicksilver, pulverized isinglass, marble dust, and other materials, in specified proportions and manner described, and designed to make a hard surface capable of receiving a very high polish.

A sawing machine has been patented by Mr. George McCormick, of Washington, D. C. It has a rectangular frame, carried on rollers at its four bottom corners, in which is a sliding frame to support and carry the saw either in horizontal or vertical position, the machine to be operated by two or four men, and being designed for sawing down trees and cutting the felled timber into pieces.

A boot or shoe stretcher has been patented by Mr. John Donovan, of Boston, Mass. This invention covers an improvement on a former patented invention of the same inventor, and provides for a more convenient adjustment of the toe pieces laterally and of the heel piece longitudinally when the stretcher is in place in the boot or shoe, and for the ready interchangeability of toe pieces of various sizes.

A nut machine has been patented by Mr. Alfred Marland, of Pittsburg, Pa. This invention covers a novel construction of machine that first hammers the iron or steel to the desired shape, then slightly presses the blank, to remedy any defects left by the hammering, and punches the eye of the nut while under pressure, without waste of the material other than that in the core.

A pump attachment has been patented by Mr. Thomas Diffley, of Rosemount, Minn. It is to prevent the water in pumps from freezing, a vent tube being secured in the pump tube, about eight feet below the curb, and a valve being arranged in a simple and firm manner in connection therewith, with other novel features, by means of which the escape of water from the pump tube may be easily regulated at the top of the well.

SCIENTIFIC AMERICAN
BUILDING EDITION.

JULY NUMBER.—(No. 33.)

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5. Design and floor plans for a carriage house and barn.
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Duplex Steam Pumps. Volker & Felthousen Co., Buffalo, N. Y.

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PRINCIPLES OF THE ECONOMIC PHILOSOPHY OF SOCIETY, GOVERNMENT, AND INDUSTRY. Van Buren Denslow, LL.D. Cassell & Co.: New York. 1888. Pp. xxx, 782. Price $3.50.

Within the limits of our space we cannot attempt to review this exhaustive work. Wealth, values and prices, poverty, capital, profit and loss, the land and labor questions, money, and the relations of the State to all these, are considered and treated in great detail. The work is written by a protectionist, who devotes one chapter more directly to free trade, and shows with great clearness the basis for his belief in the doctrine of protecting home industry. The last chapter on state action in relation to special industries is of peculiar interest. In it various leading industries, their progress and development, are considered, both with reference to England and America. This chapter is a complete *resume* of the author's doctrines, and in it the illustrations of the same are presented with much force. In addition to a very full table of contents and general index, a "personal index" is given, in which the references are restricted to proper names alone.

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Notes & Queries

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(1) B. B. A. writes: Having a horned toad in our possession (from California), and not knowing its diet, we are at a loss to know what to give it to eat. A. Its natural food is insects. In captivity it eats very little, and can subsist a long time without any nourishment.

(2) W. E. M. asks if the electromotive force generated by an armature moving in a constant magnetic field will be doubled if the speed of armature be doubled. A. Every dynamo has what is known as its critical speed. Below this it develops very little electrical energy, above it the development increases very rapidly with increase of speed. We can supply you by mail with Silvanus Thompson's "Dynamo-Electric Machinery," price $5, also Carl Herring's "Dynamo-Electric Machinery," price $2.50. These are both excellent works, and are fully up to date.

(3) S. A. S. asks: Does the use of link motion affect the lead of a slide valve or change it to any extent in shifting the link? A. The lead is and is not affected by the movement of the link. Much controversy would be saved by disputants by a positive definition of the subject of dispute. There are two kinds of link motion. One in which the link is stationary with a moving slide or block, carrying the end of the valve rod with it. This makes an unvarying lead. The other form has the valve rod and link block in a fixed line, the link being attached to the shifting bar. This is called the shifting link, and its operation causes a variable lead. This you will find fully illustrated and demonstrated in Edwards' "American Locomotive Engines," $2.00, which we can mail for the price.

(4) E. J. L.—The magnesium light is not adapted for use in enlarging, as the smoke given off obscures the light. If you use the improved gelatino-bromide paper, you can produce an enlargement in a few seconds by the aid of an ordinary kerosene light.

(5) A. T. asks for the formula for vanilla extract. A. Cut 2½ oz. vanilla beans; pour 1¼ quarts 90 per cent spirit over them, digest for some time and filter. Keep in hermetically sealed bottles. This gives the essence of vanilla. The residue may be treated with water, afterward to be decanted, which gives vanilla water.

(6) G. E. S. asks if the friction between steel and rhodium would be great enough to be objectionable, if used in a watch? A. The frictional relation of rhodium as asked is probably unknown, as it has only been made in small quantities and is more expensive than iridium. It is very difficult to manage, and is hard to cut and drill. Rhodium, like iridium, can be highly polished. For experimental purposes in the line of your inquiry, we recommend iridium, because it is a commercial metal largely used in pen making, takes a high polish, and is extremely hard.

(7) G. J. K. asks: 1. Will the power of the motor described in No. 11, March 17, be diminished by wrapping the armature with No. 20 wire, and can I then run it as a motor or dynamo at will? A. Not if the driving current is of proper character for such winding. 2. How is a spark coil made with power enough to light two or three burners? A. Wind four or five pounds of No. 22 wire around a bundle of iron wires, the bundle may be made of No. 16–20 wire, ¾ inch diameter and 7 inches long. We refer you for water motors to our SUPPLEMENTS, in which several are described.

(8) R. F. A. asks: 1. What will remove iron rust from a marble gravestone, caused by some preparation used to clean it? A. Use a solution of 1 part of nitric acid in 25 of water, and carefully applied to spots only, then rinse with water and ammonia. 2. What preparation (a liquid) is used in instruments employed to cure a cold by inhalation? A. Carbolic acid and iodine. 3. Will an electric battery run an induction coil to good advantage? A. Yes.

(9) A. C. McG. asks: 1. What force will a plunge battery of six cells, each cell containing two carbons and one zinc, 4½ x 6, give? A. It would give about 12 watts in an external circuit of resistance equal to its own. This resistance would vary according to the arrangement of the cells. 2. How long would it run two three candle incandescent lamps? A. It would not run them very brightly—with large cups it

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might last three or four hours. 3. Would the same run the simple electric motor described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 641? A. Yes. 4. How long would it run the motor? A. Three or four hours or longer. 5. How many six candle lamps will it run, and for what length of time? A. It would run one six-candle lamp about the same time, etc., as two three-candle lamps.

(10) A. O. writes: When a vessel is making a circle, where does she pivot? Some claim that the bow remains stationary and the stern does all the swinging, while others claim that both bow and stern swing, perhaps not equally—that the pivoting point comes nearer amidships. A. A vessel freely swinging under a previous momentum turns upon her center of gravity. The action of the rudder in turning a vessel under a previous momentum carries the pivoting point forward according to the intensity of its action. If under motion by side wheels, the pivoting point is carried back of the center of gravity by the action of the strong current from the wheels, while a propeller turns on a point far forward of the center, and if confined at the bow will quickly move around the bow as a center.

(11) R. K.—Three to five pounds pressure is sufficient for steam cooking of vegetables where the steam is in contact. Less pressure is often used in this way for light cooking. You can make a strong plank tub, well hooped and stayed in a frame that also holds the cover down, that will stand a half to 1 pound pressure per square inch. As you do not give the required size of the chest or box, we cannot further advise.

(12) F. M. D.—You cannot glue a piece of wood to iron that will stay for any length of time. The expansion and contraction of the wood by variations in the moisture of the atmosphere will soon pull the wood from the iron. The best way is to drill a few holes in the iron plate, and screw the board fast from beneath the iron plate.

(13) A. H. F. asks the horse power of an engine having 2½ inches stroke, diameter of piston being 1½ inches, at 50 pounds pressure, intended for running light canoe. Also necessary size of boiler and propeller. A. At 240 revolutions per minute, your engine will indicate ¼ horse power. You will need a boiler containing 5 square feet heating surface. A vertical tubular or a Shipman boiler is suitable for an atomizing burner. A screw wheel 10 inches in diameter with three blades will be suitable.

(14) M. asks: Is mineral water made of marble dust, acid, sirup, etc., injurious to the stomach? A. It is not generally considered so if not taken in excess. 2. What are the properties of quassia chips? How would you make a decoction of it, using one pound of chips? A. The properties of the quassia are those of the simple bitters, and as a medicine it is adapted to cure of dyspepsia and the debilitated state of the digestive organs which sometimes succeeds acute disease. Its preparations are officinal, and therefore we would refer you to the U. S. Pharmacopœia for their manufacture, as detailed descriptions are there given.

(15) L. B.—Yellow brass varies very much in its composition. A good dipping brass may be made with 6 ounces zinc to 1 pound of copper. A crisp, easily turned brass that takes a bright yellow dip is made with 8 ounces zinc to 1 pound copper. The best brass for fine finish and color should have 4 ounces zinc to 1 pound copper.

(16) J. A. H. asks the component parts of a cement that will mend terra cotta pipe so it will resist moisture. A. We know of nothing better than pure Portland cement. If a stronger and harder cement is required, a little water glass or soluble silica is mixed with the cement and quickly used, as it soon sets.

(17) C. B. A.—Consult Arlot's "Complete Guide for Coach Painters," which we mail for $1.25.

(18) C. R. S. asks: 1. Is tricopherous, as a head wash for dandruff, injurious or not? A. Barry's tricopherous is not injurious, and is composed of castor oil ½ pint, 95 per cent alcohol ½ pint, tincture cantharides ½ ounce, oil of bergamot 2 drachms. Color pink with a little alkanet root. 2. What is a good cure for dandruff or method of cleaning scalp? A. To remove dandruff dissolve a thimbleful of refined borax in a teacupful of water; first brush the head well, then wet a brush and apply the mixture to the head. Do this every day for a week, then less frequently.

(19) W. D. S. asks a process for cleaning oily waste so that it can be used again. A. We know of no better process than to boil the waste in a solution of sal soda strong enough to take up the oil and convert it into a soap, when the waste can be rinsed in clean water, wrung out, and dried.

(20) G. S. asks: 1. In making the simple electric motor into a dynamo, how many layers deep and how many convolutions of No. 20 cotton-covered wire do I want to use in winding the armature? A. Use 8 layers of No. 20 wire on your armature. 2. How do I want to connect it with the wires of the lamps, and what kind of a lamp do I want to use, and where can I get them? A. Connect the wires with the brushes, as in the case of the motor. Use Edison incandescent lamps of 5 or 6 candle power each. You can procure them from any dealer in electrical supplies. By a little experiment you can readily ascertain the best method of connecting up the lamps. 3. What speed do I want to run the dynamo? A. You will have to determine by experiment. 4. Will the current be dangerous? A. No. 5. Will the field magnet have to be turned smooth in the inside for the armature run in? A. It should be bored out. 6. Can I paint the field magnet? A. Yes. 7. Can I use brass or iron boxes for the shaft instead of Babbitt, as I would like to have set screws to take up the wear? A. Yes.

(21) J. J. P. asks: 1. Would the armature of iron wire for the eight-light dynamo be as good as the one built up of iron washers? A. The difference would be slightly in favor of iron rings, if they were made of thin soft iron and separated by rings of tissue paper. The reason of the superiority lies in the fact that an armature core constructed of such rings would have no interspaces. 2. Would it not be better to leave off wooden sleeve and construct armature direct upon the shaft, and hold it in place by the notched end pieces screwed on to thread cut in shaft? A. There is no objection to your method of supporting the armature ring. We do not know that it would have any advantage in the small motor or dynamo.

(22) H. S. C. writes: 1. In the construction of the simple electric motor described in your issue of March 17, we have made the field magnet of Russian iron, as directed, but find trouble in making the strips lie closely together. Will a little space between the strips injure the efficiency of the motor? A. The spaces between the layers of the field magnets should be as small as possible. The spaces between the strips will impair the efficiency of the motor. 2. Also, will the field magnet be affected, if wound with iron wire to keep the strips together? A. We do not think it will materially affect the working of the motor to wind the field magnet with iron wire as you propose. 3. Cannot the armature ring be made of Russian iron like the field magnet? A. An armature core made of iron strips would be more or less affected by induction. 4. Also will you kindly give me a recipe for making asphaltum] varnish? A. Dissolve the asphaltum in turpentine.

(23) B. W. E. writes: We have a fine cut glass cologne decanter in which the stopper is firmly set, and all efforts to remove it have thus far proved fruitless. Can you suggest any way, as it seems a pity to break the decanter? Would also like to ask what results the great Lick telescope would give if used as a terrestrial glass? A. To remove the stopper fasten firmly both ends of a strong cord six feet long, so that it will hang nearly straight and horizontal. Wind it around the neck of the bottle, and keeping it very tight move the bottle back and forth. This will soon heat the neck, and then the stopper will come out. As a terrestrial glass the Lick telescope would doubtless give very remarkable results, owing to its high magnifying powers and large aperture.

(24) R. H. H. asks: Is there any method of computing the best size and length of wire in the secondary coil of an induction coil, the size and length of the wire in primary coil being known? A. There is no regular proportion. Such data are largely empirical, but electricians are approaching the development of reliable formulæ.

(25) C. V. writes: To-day I witnessed a man trying to find a vein of water by the aid of a crotch of alder wood. Every time he struck a vein or pretended to have, the crotch would bend over, and at times would even twist right off. Could you give me any information what causes the stick to bend over? A. The motion of the fingers, hands, or wrists effects the bending. Water has nothing to do with it.

(26) G. L. B. asks how the sulphide of phenyl is prepared, and if it is an article of commerce. A. By dry distillation of sodium benzole sulphonate. It is hardly an article of commerce.

(27) W. L. M. asks for a receipt for printing badges with gold leaf with hot type. A. The ribbon is dusted with resin, gold leaf is spread over it, and the letters are impressed with a hot iron or brass type. The resin melts and causes the leaf to adhere.

(28) W. H. W.—We have little confidence in any receipt for restoring burnt steel. By burning, the relation of the elements and the granulation become changed, and no ordinary application upon the surface will restore the internal structure. Better send it to the scrap heap or use it for some inferior purpose. If you desire to try and restore it, proceed as follows: Bring the steel to a red heat, sprinkle with a mixture of 8 parts red chromate of potassium, 4 parts saltpeter, 4 parts resin, thoroughly pulverized and mixed, and work the steel well under the hammer. For welding cast steel, use 10 parts borax, 3 parts sal ammoniac, 3 parts ferrocyanide potassium, ⅛ part of resin, well pulverized and mixed. Heat to drive off the water of crystallization of the borax, and again pulverize. Heat the steel to red and sprinkle with the mixture, then heat to full yellow and weld.

(29) O. R. asks: 1. What kind of cement would be best for building a pit in which to dissolve bones in sulphuric acid? A. Build the acid pit with trap rock, red sandstone, or very hard burned bricks and Portland cement. Plaster with Portland cement wet with water glass applied quickly, as it soon sets. Then for further acid-proofing apply a coat of paraffine melted to the surface by applying hot irons or a pan of hot coal close to it. If you wish to omit the water glass, an application of a paraffine coat directly upon the Portland cement, and combining it well with the cement by heat, may answer your purpose. 2. Is there any solution that will prevent the effects of sulphuric acid on cotton overalls? A. Rub paraffine all over the surface and melt it in with a hot iron as in ironing.

(30) W. H. P. asks a cheap process for bronzing small iron castings. Have tried shellac, but it went on uneven. A. Brown japan varnish thinned with turpentine to give the desired color makes a smooth and pretty finish for small castings. Tumble the castings in sawdust wet with sulphate of copper solution. Rinse in hot water, dry, and dip in a very thin shellac varnish. The goods should be hot (about 212°) when varnished with shellac. A little gum dragon blood improves the shellac varnish. The great trouble with amateurs comes from the use of too thick varnish.

(31) W. S. R. asks what kind of small appliances to get to melt brass in small quantity, say one pound or half pound quantities, for making small castings, and what is the best substance to use for moulds for making small, fine castings. A. You will need a black lead crucible of a size to hold the half pound or pound of metal, and a small pair of jeweler's tongs to handle the crucible. Any cylinder stove with a good chimney draught will answer the purpose of a furnace. Set the crucible about 4 in. above the grate, and fill up around with coal (stove size). Let the fire burn up for a few minutes and feed in the brass in small pieces, or such as will drop into the crucible, with the tongs. Place a large piece of charcoal over the crucible, give the fire its best draught, and the metal will soon melt. Mould your work in fine moulding sand, such as used by brass founders. You can obtain what you need at a foundry. If possible, go to a brass foundry and inspect the operation of moulding and casting before making the trial. To post you in all the particulars, get the "Brass Founder's Manual," by Graham, which we can mail to you for $1.00.

(32) T. J. V.—For a good and lasting roof paint, that will not run in summer or crack in winter, take equal parts by measure of any two earth colors, as pulverized slate, pulverized mica schist, or any of the cheap dry paints commonly used for painting barns and fences, to suit your taste as to color, and add half the bulk of the two kinds of paint in pulverized resin. Thoroughly mix and add an equal bulk of pure coal tar, which you may obtain through the paint trade. Boil and stir until the resin is thoroughly melted and the whole mixed to a uniform fluid mass. The quantity of coal tar may be varied to facilitate application with a brush.

(33) Dr. H. S. asks for the definition of the word myoma. A. Myoma is a term applied by Professor Virchow to a variety of sarcoma (or flesh tumor) which is mixed with striped muscular fiber. It is very fatal if not promptly excised.

(34) C. H. S.— One of the fundamental propositions of geometry proves that the areas of polygons increase with the number of their sides for given perimeters. Hence a circle, which is a polygon of an infinite number of sides, has the greatest possible area within its perimeter. Your scheme of raising water to a height of 200 feet with compressed air is not practicable. It will take 90 pounds pressure, or 13 cubic feet of air compressed to 1 cubic foot, to sustain the column. It will then take an equal bulk of compressed air to lift a given bulk of water without friction. The compression of the air to so great a pressure is the stumbling block to this kind of work. For table of compression of air, see SCIENTIFIC AMERICAN SUPPLEMENT, No. 279, and for the theory of compression, SCIENTIFIC AMERICAN SUPPLEMENT, No. 323, both most interesting and valuable papers.

(35) H. S.—The plant was so decayed and mouldy when it arrived as to render recognition impossible.

(36) C. H. E. asks a receipt for making a cold tinning solution for brightening articles made of tinned wire that have become dimmed. A. For this process the articles must be thoroughly cleaned by boiling in alkali, washing, or sand scrubbing, then immersing in a tin bath, which may be made with 10 ounces dry tin salt (chloride of tin), 10 ounces alum, 7 ounces cream of tartar, 20 gallons of water, or in proportion for smaller quantities. A strip of pure tin (block tin) should be attached to the articles when immersed. Articles to remain in bath from 1 to 8 hours, according to thickness of tinning required. Wood or stoneware should be used for holding the solution. You can obtain the chloride of tin through the drug trade.

(37) A. C. B.—The mathematical center of revolution or axis is an imaginary line through all revolving bodies. It is not necessarily endowed with motion. The material or physical properties of all material bodies in revolution move on a mathematical center; even the molecule on the center turns.

(38) C. W. G. asks how to convert malleable casting into steel before being annealed or after annealed. A. Malleable castings pass through the condition of a steel casting during the annealing process. By arresting this process before it is finished, the metal will be found to have some of the properties of steel. The annealed castings may also be recarbonized by cementation.

TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

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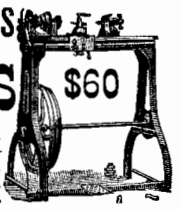

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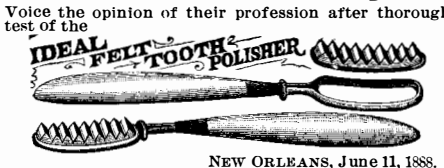

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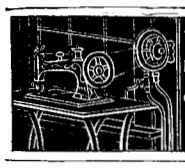

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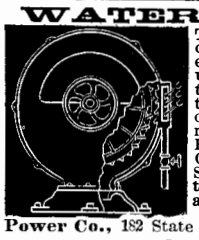

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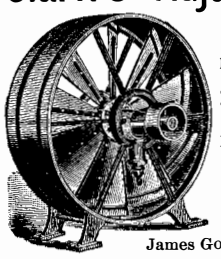

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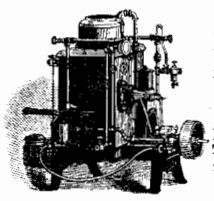

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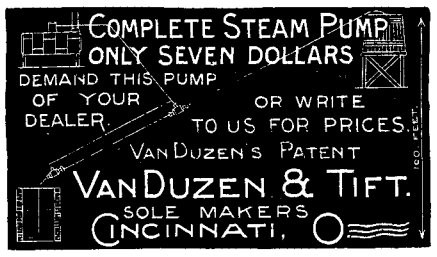

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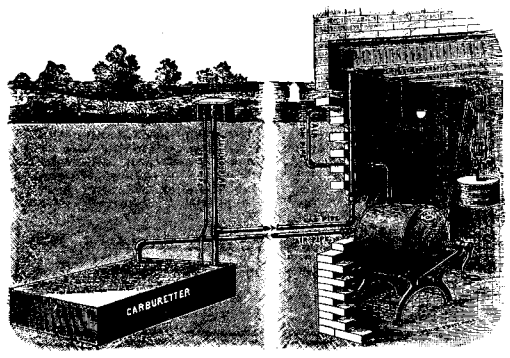

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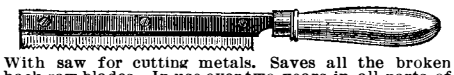

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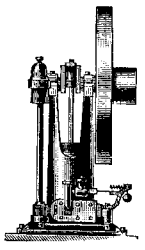

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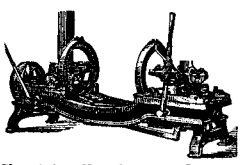

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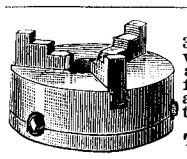

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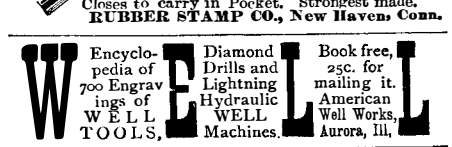

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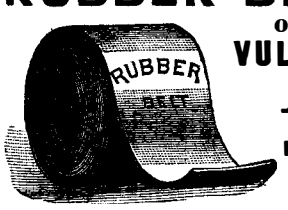

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D. B. HARMONY, *Acting Secretary of the Navy.*

Proposals for Steel for Use in the Construction of the United States Armored Battle Ship "Texas" at the Navy Yard, Portsmouth, Virginia.—NAVY DEPARTMENT, WASHINGTON, D. C., *June* 21, 1888.—Under authority conferred by an act of Congress, entitled "An act to increase the naval establishment," approved August 3, 1886 (24 Statutes at Large, page 215), sealed proposals are hereby invited, and will be received at this Department until 12 o'clock noon on Monday, the 23d day of July, 1888 for furnishing the following classes of material for use in the construction of said ship: CLASS A.—*Steel plates.*—About nine hundred and twenty (920) tons of steel plates from 2½ to 25 pounds per square foot. CLASS B.—*Steel shapes.*—About five hundred and three (503) tons of steel shapes, as follows: About two hundred and seventy (270) tons of angle-bars of various sizes; about one hundred and thirty-two (132) tons of angle and T-bulb beams, with proper curvature, from 11 to 24½ pounds per lineal foot; about ten (10) tons of T-bars, of 8 pounds per lineal foot; about ninety-one (91) tons of channel-bars, of 10, 15, and 25 pounds per lineal foot. CLASS C.—*Steel rivets.*—About one hundred (100) tons of steel rivets from ⅜ inch to 1¼ inch diameter. CLASS D.—*Steel castings.*—About one hundred and twenty (120) tons of steel castings, of various shapes, including stem, stern-post, bawse-pipes, riding and mooring bitts, chain-pipes, etc. The tons of material herein called for to be of 2,240 pounds each. All said material to be of such detailed dimensions, weights, and shapes as may be required in the construction of the vessel, and to be delivered at such place or places in the Navy Yard, Portsmouth, Virginia, as may be designated by the Commandant of said Yard. Deliveries to commence within thirty (30) days from the date of contract, and to be completed within six (6) months from such date; the material to be delivered promptly, in accordance with a detailed schedule prepared by the Assistant Naval Constructor at said Navy Yard, and in the order required to carry on the work to the best interests of the Government. All material to be of domestic manufacture, and to be accepted only after passing such tests as may be prescribed therefor by the Secretary of the Navy. Proposals must be in accordance with forms which will be furnished on application to the Bureau of Construction and Repair, and may be for one or more of the classes designated, but no bid for a portion of any class will be considered. Each proposal must be accompanied by satisfactory evidence that the bidder is able to furnish and deliver the material for which he bids. Each proposal must be accompanied by a certified check, payable to the order of the Secretary of the Navy, for an amount equal to five per cent. of the bid. The check received from the successful bidder will be returned to him on his entering into a formal contract for the due performance of the work, and giving bond for the same, with satisfactory surety, in a penal sum equal to twenty-five per cent. of the amount of his bid; but in case he shall fail to enter into such contract and to give such bond within twenty days after notice of the acceptance of his proposal, the check accompanying such proposal shall become the property of the United States. All checks accompanying proposals which are not accepted will be returned immediately after the award shall have been made. Information relative to the dimensions and shapes of material, and all other information essential to bidders, will be furnished on personal application to the Bureau of Construction and Repair, Navy Department. Proposals must be made in duplicate, and inclosed in envelopes marked "Proposals for Steel for the Armored Battleship 'Texas,'" and addressed to the Secretary of the Navy, Navy Department, Washington, D. C. Each class of materials will be bid for separately, and the Secretary of the Navy reserves the right to reject any or all bids or the bids on any class or classes, as, in his judgment, the interests of the Government may require.
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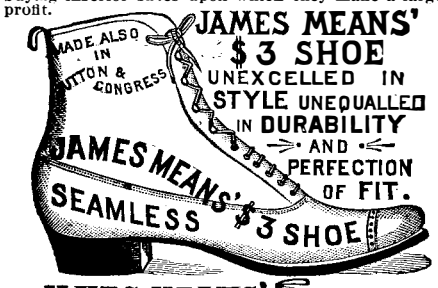
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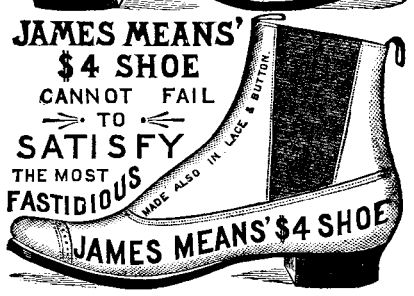

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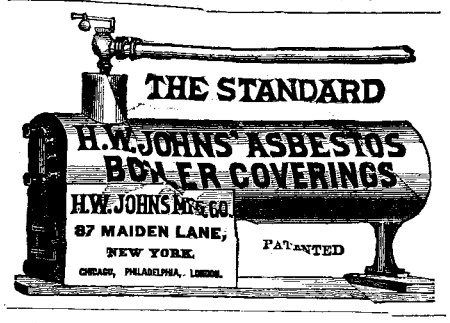

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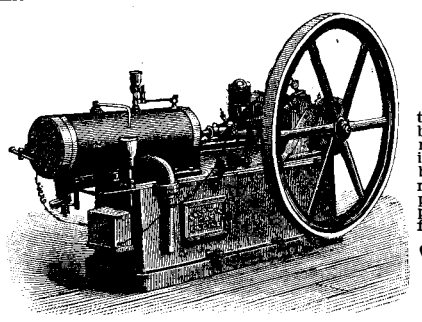

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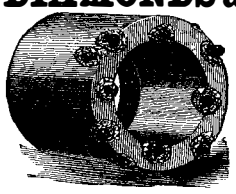

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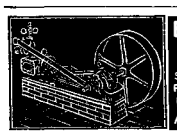

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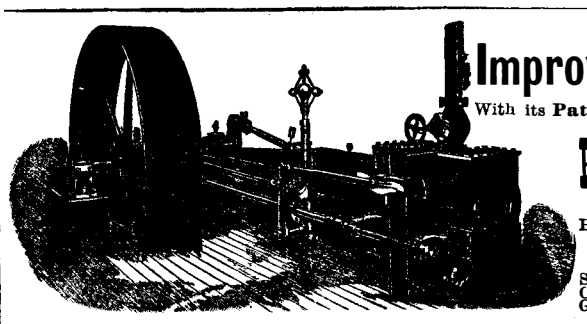

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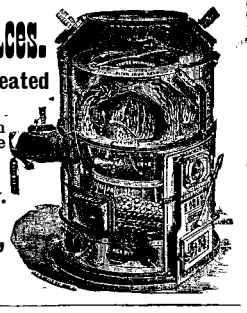

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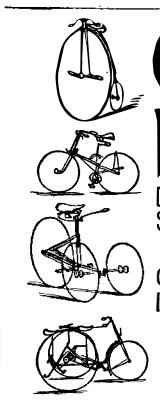

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